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GENERAL J. T. WALKER, C.B., F.R.S., &c., Member of Council, in the Chair.

THE DEVELOPMENT OF FIELD ARTILLERY MATERIAL.

By Lieutenant-Colonel N. L. WALFORD, R.A.

THE Franco-German War of 1870, owing not only to the colossal scale of its operations and to the far-reaching character of its results, but also to the persistence with which we have been called upon to regard its lessons as embodying all that is essential in tactics and strategy, has grown to be considered as an absolute standard, any divergence from which requires explanation if not excuse. There is thus much danger that its name may become a fetish, and the outcome of its experience a formula to be accepted, but to be by no means criticized.

The War of 1870 marked the first grand stage since Waterloo, for the Wars of 1848, of the Crimea, of 1859, and even of 1866 (of which the results were scarcely inferior), are almost forgotten, while the later war between Russia and Turkey, which was a more severe and far more costly struggle, has, so to speak, never been remembered. The reason of this pre-eminence of the War of 1870 is not far to seek; it is founded on the fact that this war was a duel between the two most skilful warrior nations in Europe, and was as such followed with the same intense interest as would be excited by a contest between two passed masters in fencing who had been rivals since they could handle a foil, whose reputation was unequalled, and whose skill was supposed to be irreproachable. The campaign of 1870 was a lesson in war given by experts to Europe, and as such it is still regarded. It emphatically marked an epoch, but that epoch is past.

This war, though of the very first importance to the military

student, is indeed an old tale, more than twenty years old, and twenty years, as the world moves now, is a very long time, and entails very considerable changes. This fact is especially true of material, since while opportunities for the practical study of tactics occur only at, sometimes, considerable intervals, the progress of material is unceasing; for it advances with the march of science, with improvements in methods of manufacture, and with the development of the skill and resources of a nation. That which we could not attempt twenty years ago is now, in many cases, an accomplished fact; to take one single instance, the last twenty years have seen the death of the iron age for guns and armour, and the birth of the present age of steel: such guns and armour as we now have were impossible in 1870, and will, in their turn, be obsolete twenty years hence. For neither invention nor enterprise will stand still; woe to us if we do not advance with them!

It may be said, however, that the progress of material is a purely technical matter, interesting to those who are concerned with it, but by no means a necessary part of military knowledge. Those who so speak cannot have studied past history, for, if we examine the changes which mark the growth of the art of war, we shall find that some variation in material underlies most of the successive modifications of tactics. It is interesting to note how in the 16th century the gradual increase of the proportion of musketeers to pikemen slowly modified the tactics of the day, while the invention of the bayonet (which caused the abolition of the pike) resulted in the first appearance of the line as a formation for infantry. Again the struggle to obtain a quicker rate of fire, or rather I should say a more rapid rate of loading, led to the successive invention of the bandolier, the flint lock, the iron ramrod, the cartridge, the percussion lock, and the breechloader; each of these in its day exercised a preponderating influence on the tactics in vogue, while the effect of their direct successor, the magazine rifle, is one of the questions of which we anxiously await the solution from the next great war.

Following the universal law of progress, Artillery has since 1870 tended to develop in every direction; the guns of the present day are more accurate, and have a longer range than those then in use, the projectiles are more effective, the character of the powder has improved, the fuzes are incomparably better (though there is yet some improvement possible in this respect), while greater knowledge and experience have been brought to bear upon the various problems connected with the draught and stability of gun-carriages. Time will not permit me to say much about the past, interesting as such a retrospect would be, but I will ask you to let me draw your attention to one fact which alone would show how different are the results which, in the next war as compared with that of 1870, we may expect from the fire of artillery. In the Franco-German War, the German Army, with the exception of the Bavarians (who had a very inferior shrapnel), possessed but one projectile, the common shell, and but one fuze, a percussion fuze, while the French, who had, it is true, a shrapnel in addition to the common shell, had for the majority of

these projectiles a time fuze, which was so absurdly constructed that it would act at only two ranges, 1,500 and 3,000 metres; if, therefore, the enemy happened to be at any other distance, the shell became practically solid shot. We need scarcely wonder that, under these circumstances, the loss of the Germans from the fire of the French artillery was so small.

The subsequent improvement of the projectiles of field artillery may be best estimated from the fact that the shell used by the Germans in 1870 gave about thirty to forty splinters at its burst, while their present ring shell gives from 150 to 180, and their shrapnel discharges 262 bullets; this latter projectile is, moreover, fitted with an admirable time fuze, which acts with very great regularity at all ranges up to 3,500 yards.

It is proposed to divide the consideration of artillery material under four heads; viz.:—

I. The gun.
II. The carriage.
III. Ammunition.
IV. Miscellaneous.

I. *The Gun.*

Present Armament.—The field guns of the principal European nations are as follows:—

Austria.—Two descriptions of guns, both made of hardened cast bronze.

i. Calibre, 3·14-inch; weight, 5·9 cwt.; m.v., 1,365 f.s.; common shell, 9·5 lbs.; shrapnel, 10·27 lbs.
This gun is issued to horse and light field batteries.[1]
ii. Calibre, 3·54-inch; weight, 9·5 cwt.; m.v., 1,440 f.s.; common shell, 14·1 lbs.; shrapnel, 15·6 lbs.
The gun for heavy field batteries.

France.—Two guns, of which the tube and jacket are made of cast steel, and the reinforcing rings of puddled steel.

i. Calibre, 3·14-inch; weight, 8·4 cwt.; m.v., 1,607 f.s.; common shell, none; shrapnel, 13·8 lbs.
ii. Calibre, 3·54-inch; weight, 10·4 cwt.; m.v., 1,492 f.s.; common shell, none; shrapnel, 19 lbs.
The first is the horse, the second the field, artillery gun.

Germany.—One gun (slightly lightened for H.A.), made of forged steel.

Calibre, 3·46-inch; weight, 8·85 cwt. (for H.A. 8·2 cwt.); m.v., 1,407 f.s.; common shell, 15·5 lbs.; shrapnel, 17·7 lbs.

[1] I have been informed, on the best authority, that the Austrians have now abolished light field batteries, and that their field artillery has now but one gun, the 3·54-inch.

Great Britain.—One gun, made of forged steel.

Calibre, 3-inch; weight, 7·5 cwt.; m.v., 1,720 f.s.; common shell, 12·5 lbs.; shrapnel, 12·5 lbs.

Italy.—Two guns, both made of hardened cast bronze.

i. Calibre, 2·75-inch; weight, 5·8 cwt.; m.v., 1,400 f.s.; common shell, 9·4 lbs.; shrapnel, 9·8 lbs.
This gun is used by the horse and light field batteries.

ii. Calibre, 3·5-inch; weight, 9·2 cwt.; m.v., 1,480 f.s.; common shell, 14·7 lbs.; shrapnel, 15·3 lbs.
This is the gun of the heavy field batteries.

Russia.—Three guns, all made of forged steel.

i. Calibre, 3·4-inch; weight, 7 cwt.; m.v., 1,351 f.s.; common shell, 14 lbs.; shrapnel, 15 lbs.
The horse artillery gun.

ii. Calibre, 3·4-inch; weight, 8·6 cwt.; m.v., 1,450 f.s.; common shell, 14 lbs.; shrapnel, 15 lbs.
The light field battery gun.

iii. Calibre, 4·2-inch; weight, 12 cwt.; m.v., 1,223 f.s.; common shell, 25·9 lbs.; shrapnel, 27·5 lbs.
The heavy field battery gun.

The diversity of these guns is remarkable, so much so that it is impossible to discover any general principle on which they have been selected; for example, the weight of shell varies from 9·4 lbs. of the Italian light gun to 27·5 lbs. of the Russian heavy field battery gun, while the muzzle velocity varies from 1,223 f.s. in the last-named gun to the 1,720 f.s. of our 12-pr.

This fact is in part due to the fact that most of these guns are really obsolete; for example:—

Austria: Pattern of 1875.
France: Pattern of 1877.
Germany: Pattern of 1873, slightly modified in 1888 as regards the horse artillery gun.
Italy: Patterns of 1874 and 1876.
Russia: Patterns of 1877, modified in 1879.

The adoption of a new pattern by one of the above Powers would probably be the signal for an entire renewal of the field artillery of the world, and such a renewal (which is already foreshadowed in the case of France) will probably take place as soon as smokeless powder has been generally and definitely adopted; in the meantime, since the re-armament of a gigantic artillery must be a matter of very serious expense, all nations are content to forego an advantage which has been as yet taken by none. It may be well to endeavour to point out the direction in which further progress, when the time for it arrives, will probably be made.

Signs of the Future.—There are certain signs which point to the

possible adoption, in imitation of the infantry rifle, of a small calibre, a shell of great length, and a high muzzle velocity, and it will be interesting to examine the effect of such a choice.

The use of a *small calibre* will necessarily entail the employment of a shell of small section, while in order to resist the action of the pressure needed to generate a high velocity, the shell must, even if it be made of forged steel, be of considerable strength, and, therefore, of a certain thickness. Such a shell will, even though it be made of great length (say 6 calibres), have but a comparatively small content, either of bursting charge or bullets; as regards common shell, this defect may perhaps be made good by the use of a high explosive (of which we shall speak presently), but with respect to shrapnel it cannot be surmounted.

The *use of a long shell* is intended to serve two objects, viz.:—

i. To supply the necessary space for the burster or the bullets.
ii. To ensure a high remaining velocity.

On the other hand, its employment necessitates the use of a rapid twist of rifling, and will probably affect injuriously the accuracy and the length of life of the gun.

The *high muzzle velocity* will be needed to give the requisite rotation (without an excessive slope of rifling) to the long projectile, and is further desired by some Officers for its own sake.

It is said, and is undeniable, that a high velocity will give a flat trajectory, and it is assumed that a flat trajectory will add to the efficiency of the gun. This contention is undoubtedly true of a rifle, which throws a solid bullet, and is equally true of a solid shot, and to some extent of a percussion shell which strikes before it bursts. Shrapnel is, however, and appears likely at present to remain, the principal projectile of field artillery, and the question should, therefore, I urge, be considered mainly from the point of view of its effect on that shell. A shrapnel shell bursts in the air, its bullets descending in a cone of which the apex angle is approximately 12 degrees; this being the case, it is evident that the dangerous zone, which the flat trajectory is intended to increase, will depend less upon that trajectory than upon the height of the burst of the shrapnel and the slope of the ground on which the target stands; in other words, the number of bullets which sweep the ground will vary under different circumstances, and is very slightly dependent upon the direction of the motion of the shell before it bursts. For the above reasons, it appears doubtful whether an increased muzzle velocity will give a more effective shrapnel, more especially since the high velocity of rotation will tend to give very great dispersion to the bullets at the moment of burst. I should, however, perhaps, warn you that I am now trotting out a special hobby, which may really be as lame as most hobbies.

The reasons which have been given above, viz., the limited content of a small calibre shell, the difficulty of obtaining accurate shooting with a shell of great length, and the slight advantage, if any, to be obtained from a high muzzle velocity (which carries with it many

difficulties) incline me to the belief that the direction in which the progress of field artillery appears to show a tendency to move is an erroneous one, and that a return will, after a trial, be made to the principle that the main object of artillery is not to hit a given mark with unerring accuracy, but to obtain the greatest possible effect from its shrapnel, a condition which is incompatible with a small calibre, even though the shell be lengthened, while it is not facilitated, and is perhaps even rendered more difficult of fulfilment, by a high muzzle velocity.

Quick-firing Guns.—Passing from this subject, we come next to the desire which many Officers have expressed to introduce a quick-firing gun for the use of the field artillery.

We all know that guns have been invented which will throw as many as 40 projectiles per minute, and this rate of fire, provided that the practice be accurate, must be acknowledged to be overwhelming. Such extreme rapidity is, however, possible only in the case of guns of very small calibre, the objections to which have been already stated.

Other quick-firing guns of larger calibre, up to 3 and even 4 inches, can be fired at the rate of from twelve to fifteen rounds per minute, which is, of course, in excess of the rapidity possible with ordinary B.L. guns. This rate is, however, attainable only in the case of unaimed or uncorrected fire, that is to say, on condition that the gun be not re-laid between the rounds. It is evident that such a power of rapid fire is, therefore, of value only when the gun is on a fixed mounting, and will be practically useless (since the fire will be inaccurate) when the gun it on a field carriage, except under two conditions, viz., either

The field carriage must, when the gun is fired, have no recoil or other motion which can disturb the aim; or

The target must be of such a character and at such a distance that accuracy of aim is not necessary.

Of these conditions, the first has not as yet been attained on a field carriage with any gun of a sufficient calibre, while the second would limit the use of a quick-firing gun to occasions when case-shot is the best projectile, under which circumstances its place might with advantage be taken by a machine gun.

Even though it be admitted that the rate of fire of a quick-firing gun must in practice be limited by the necessity of re-laying it after each round, its advocates may yet claim in its favour that, like the B.L. rifle, it is always loaded; even this is, however, not strictly the case, for ammunition must be brought up to the quick-firing as to the ordinary gun, and the time required for this operation will in each case be the same.

As a matter of fact, the rate of fire of artillery in the field is governed by the time required to run up and lay a gun, together with that necessary for bringing up the ammunition; the operations of opening and closing the breech, and of putting in the shot and cartridge, can be performed as quickly as is needed with any B.L. gun. In conclusion, it may be said, therefore, that, with respect to rapidity

of fire, no advantage would be gained by the introduction of quick-firing guns for field artillery, except as regards the fire of case.

On the other hand, it may be acknowledged that no disadvantage would attend their use, except beyond as is caused by the fact that they are dependent on a metal cartridge case, and that thus each round of quick-firing ammunition is heavier than a round of the corresponding ordinary ammunition by the difference in weight between a silk cartridge and this metal case. That excess of weight would, however, seriously diminish the number of rounds which it would be possible to carry. For example, thirty-two rounds of the present 12-pr. ammunition weigh 4·7 cwt.; for this weight it would be possible to carry only twenty-seven rounds of quick-firing ammunition, a reduction of 16 per cent.

Some of the quick-firing breech actions are, however, extremely simple, especially as regards their means of igniting the charge, and it is very probable that, if the artilleries of Europe are re-armed, some such form of breech action will be adopted, the increase of weight due to the cartridge case being counterbalanced by the diminution which is made possible by the change from black to smokeless powder.

Field Mortars.—In addition to the inclination which has been mentioned above, to test the value of a small-bore, high-velocity gun carrying a long shell, we find a tendency in almost all European armies to revert to the employment of field howitzers or mortars, throwing a heavy short shell with a low velocity. This type of field gun has of late years been abandoned, except in the case of our heavy field batteries in India, but there is now a very marked movement, led by Russia, in favour of its re-introduction.

It has been foreseen that the defensive positions of the future will, wherever possible, be provided with entrenchments, of great extent and of considerable strength, and it is recognized that against such defences the projectiles of ordinary field guns will be practically powerless, while the flatness of their trajectory will render it difficult, if not impossible, to obtain good effect from their shell on troops who are retained under cover. It is, therefore, now generally agreed that a field army must in future be provided with a certain proportion of mortar or howitzer batteries, which shall throw a shell of considerable weight, but with a very low muzzle velocity, thus obtaining a high angle of descent. Against such a projectile the defenders would be without protection, except on the condition of providing a very large amount of good overhead cover, while such a provision would in most cases be impossible in the field, on account either of want of time or of want of material.

Russia, incited perhaps by recollections of Plevna, has alone at present completed an organization of this description; she has two regiments, each of four mortar batteries, the piece itself having a calibre of 6 inches, and throwing a shell of about 60 lbs. Since the equipments of other nations are still in the experimental stage, it is impossible to give accurate details, but the following data are founded upon good authority.

Austria: Calibre, 4·7-inch.
France: Calibre, 6-inch.
Germany: Calibre, 4·7 or 6-inch; one battery per army corps.
Italy: Calibre, 3·5-inch. (The same as that of the heavy field gun.)
Spain: Calibre, 6-inch. (Gun of position.)
Sweden: Calibre, 4·7-inch.
Switzerland: Calibre, 4·7-inch.

The one great objection to this addition to the field artillery lies in the undoubted want of mobility of such a battery, since even though the howitzers (as may be possible) be kept within reasonable limits of weight, their shell, if they are to be really effective, must be of considerable size, and the choice thus lies between carrying a very few rounds or transporting a vast weight of metal. For example, 37 rounds of the Russian 60-lb. shell will weigh a ton, which is, roughly speaking, as much as can be carried in a limber and wagon, each of which shall have 50 cwt. behind the team.

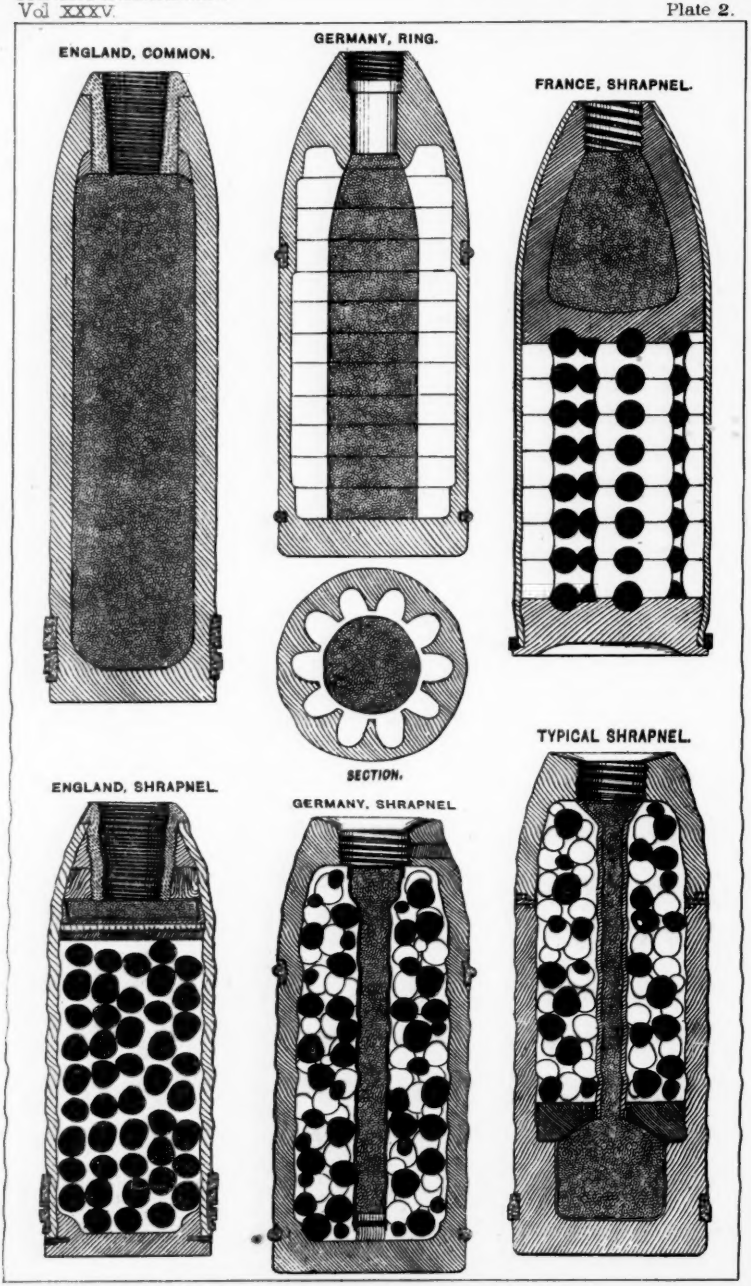
The Russians, to some extent, get over this difficulty by allowing in these, as in all, batteries twelve wagons to the six guns.

The advantage of possessing a howitzer which will throw a heavy shell is undeniable, more especially in the case where an enemy has been permitted to thoroughly entrench himself in a defensive position, for high-angle fire alone can reach troops who are behind really good cover, whether natural or artificial, while the great elevation at which the mortars will be laid will enable them, if their position be well chosen, to discharge their duty with absolute immunity from injury from the fire of guns of comparatively high velocity; there must surely be, nevertheless, some hesitation in accepting a weapon of which two projectiles weigh more than a cwt. as the arm of a field (and therefore, presumably, mobile) battery.

Uniformity of Calibre.—The question of uniformity of calibre, which simplifies manufacture in peace, and the supply of ammunition in war, has, up to the present time, been practically tried by Germany alone, but there are not wanting signs to show that this problem will be seriously considered by other nations when the time arrives for the re-armament of their artillery.

The Germans, using the same gun for horse and field batteries, have lightened it for the former, to the extent of 67 lbs., by turning down the gun, by hollowing out the trunnions and by chambering the breech-wedge; they have further lightened the gun-carriage axle by 50 lbs.,[1] and the limber by 121 lbs.; with the result that the total weight behind the team of horse artillery is (no men being mounted in either case), 2·5 cwt. less than is the case with the field gun.

[1] This has, it is reported, been effected by the use of a hollow axle, made of a steel tube drawn by the Mannesmann process; a similar tube, made in the same manner, is used by the Gruson factory for the trail of a mountain gun-carriage.



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II. *The Carriage.*

On this subject I propose to say very little, since the tendency throughout Europe with regard to this portion of the equipment is the same, though the extent of its practical expression varies in proportion to the manufacturing skill and financial position of each Power.

Material.—The carriages of all artillery have been made, of late years, both lighter and stronger, by the employment of steel, both for the carriage itself, for the axles, for the naves, and for the tires; there are, however, numerous instances of the survival of iron and even of wooden carriages, but they will certainly tend to disappear.

Brakes.—Owing to the increased muzzle velocity of field guns, it has been found necessary to use special means to check the recoil, in order to, as far as possible, diminish the physical strain brought upon the men of the detachment by running-up after each round; these may be divided under two heads:—

i. Nave brakes, such as the Gruson, and that on the 12-pr. carriage, Mark I.

ii. Tire brakes, such as the Lemoine, the German service, the Buffington, and that on the 12-pr. carriage, Mark II.

I regret to say that time will not allow me to enter upon a description of these brakes, still less to open a discussion upon the vexed question of the relative superiority of nave and tire brakes, but it would appear that general opinion declares strongly in favour of the latter.

Buffers.—The strain brought upon the carriage by the sudden check given to the recoil by any kind of severe brake (and if the gun have a high muzzle velocity, all brakes must be severe in order to be efficient) is so heavy that the destruction of the carriage can be only a matter of time, unless this shock be gradually brought to bear upon the inert mass. This need is met by the employment of a buffer—hydraulic, air, or spring—which absorbs the first blow of the recoil, and, so to speak, hands it on gradually to the carriage.

Owing to the exceptionally high muzzle velocity of our 12-pr., we have, up to the present, paid more attention than other nations to the construction and use of these buffers, as applied to field guns, but any reconstruction of material will certainly be accompanied by their more general use.

Though much remains yet to be said upon the subject of military carriages, you will perhaps excuse me if, our time being so limited, I now pass on to—

III. *Ammunition.*

Projectiles.—Omitting case-shot, which is the same in all armies, and a new variety of shell, of which I shall speak later, the typical field projectiles are—

(*a.*) A shell for ranging, generally called common shell.
(*b.*) A man-killing shell, or shrapnel.

If we examine the former of these, as exemplified by the material of England, France, and Germany, we shall find that there appears to be some difference of opinion between the artillery experts of these several armies. We use a forged steel shell containing 2 lbs. of powder, the Germans have a cast-iron ring shell with a bursting-charge of 6 ozs., while the French employ their shrapnel shell (which in the horse artillery gun holds only 2 ozs. of powder) for the purpose of ranging. These differences are, however, easily explained.

Our shell was designed with the idea that a large bursting charge would be useful in destroying field entrenchments, a task which is now, I believe, accepted by all as being beyond the power of field guns. The French and Germans have, on the other hand, assumed that a shell which is to be used in ranging should be of a character to inflict considerable loss on the enemy even while the process of ranging is going on; in order to ensure this effect, they have been willing to render the observation of their fire difficult, by diminishing the bursting-charge, and therefore the amount of smoke given by an exploding shell. The French, going beyond the Germans in this direction, have, with a view to the further advantage gained by using only one projectile for each nature of gun, restricted themselves to a shell of which the burst must be very difficult to see, except under peculiarly favourable conditions.

When we turn to shrapnel, we find again a difference of opinion; we and the French place the burster in the head of the shell, which is contrary to the practice of other nations, who all use a burster in the centre or in the base, in which latter case it is connected with the fuze by means of a tube which passes down the axis of the shell.

These differences are also easily explained. The French and English place the burster in the head, because it is for our purposes essential that the shrapnel shall burst on graze when used with a percussion fuze; but these purposes are not identical. The French need percussion shrapnel for the process of ranging their batteries; we require it because, our common shell not being a man-killing projectile, we must trust percussion shrapnel in cases where there is no time for the setting the more complicated time fuze, as, for instance, when a battery is suddenly charged by cavalry. A shell which, like the German, has its burster in the centre, and still more a shell which has the burster in the base, would be less effective with a percussion fuze than ours, since the length of time required to carry the flash of the fuze down the shell to the burster would allow the projectile to rise some distance from the ground before exploding, in which case most of the bullets would be thrown into the air over the heads of the enemy. Among nations which differ from us in the construction of shrapnel, the part which we allot to percussion shrapnel is played by ring shell, and with good effect. For example, thirteen rounds of ring shell with percussion fuzes from a 6-pr. gun gave 277 hits on a line of twenty skirmishers, standing at a range of 1,640 yards, two men only being unhit.

Those armies who prefer shrapnel carrying its burster in the base state that they do so because, if it be the head, its explosion tends

not only to diminish the velocity, but also to increase the dispersion, of the bullets, while their system, on the contrary, increases the velocity at the decisive moment and does not injuriously affect the dispersion. There appears to be much truth in these statements, for it is found in practice that the shrapnel with the burster in the base does not, in order to produce an equal effect, require to be burst so close to the target as is the case when the burster is in the head; the former does not, therefore, in its use, require the same accuracy either of ranging or of fuze as is the case with the latter. Such a shell is, however, as I have said, far less effective when used with a percussion fuze than is the pattern which we at present possess. It will be observed, on reference to the list of European artillery on pp. 323, 324, that the French, German, and Russian shells are of great size and weight.

Common Shell filled with a High Explosive.—We are most of us aware that those substances which we term "high explosives" act, when detonated, with tremendous local power, to which not even the toughest steel offers any effectual resistance, and we shall not therefore be surprised to find these terrible forces called into play in war.

High explosives have been adopted for the bursting charges of field common shell by both the French and the Germans, and trials have been made in the same direction by other nations. In order to take full advantage of this bursting charge, there is a tendency to use shells of great length and of large capacity.

The French shell is a steel common shell, four calibres (as an experiment even six) in length, filled with cresylite,[1] of which it holds 3 lbs.; it is used with a percussion fuze, and is intended to destroy cover, such as earthworks, walls, &c. A ninth wagon has been added to each heavy battery for the purpose of carrying seventy-five of these projectiles.

The German shells which replace a portion of the complement of powder shell are of the same weight as the ring shell (15·8 lbs.), and are filled with wet guncotton with a dry guncotton primer; they are intended to be used as a rule with a time fuze against men.

The theory of the use of this shell is as follows:—

It is recognized that, owing to the low trajectory of modern artillery, troops can obtain shelter from its fire by standing close into a parapet, provided (as will generally be the case) that this parapet is too thick to be breached by field guns; the German military authorities have considered that, under these conditions, the ordinary fire of artillery may, as at Plevna, be found useless for the purpose of preparing the infantry attack on a strongly fortified position, since the defender's infantry will remain under cover up to the moment when the guns of the assailants will be compelled to cease firing (owing to the advance of their own infantry), and will then, having suffered no previous loss, be prepared to offer a stubborn resistance to the

[1] Cresylite is a compound of cresol, as melinite is of phenol, each of these being a product of gas-tar.

endeavours of the attacking troops to pass over such open ground as may lie in front of the entrenchments.

Realizing the absolute necessity of reaching these sheltered troops with artillery fire, the Germans propose to take advantage of the fact that the enormous local power of a high explosive is able to altogether overcome the velocity of the projectile at the moment of burst, and thus distributes the splinters of the shell in all directions; they anticipate that it may, therefore, be possible, by bursting shell in rear of the concealed troops, to drive splinters in upon them from the rear, and thus to some extent to cancel the value of their cover. It is, however, evident that, in order to obtain such an effect, the burst must be very accurately timed, while the difficulty of ensuring this exactness will be much increased in practice by the fact that the absence of smoke from the detonation of guncotton will render uncertain the observation of fire.

From what has been said above, it will be evident that the two nations have assumed totally distinct objects in their use of high explosive in the field; the French have prepared what is practically a flying mine of enormous power, intending to destroy such cover as the enemy may make or find, while the Germans hope to produce an equal effect by rendering the protection of the parapet valueless, and to thus attain their object without the necessity for the expenditure of time, which must always be required for the destruction of earth parapets. The next war will possibly enable us to judge as to which of the two nations has reasoned most rightly.

I have said "may possibly enable us to judge," for the reason that it does not appear certain that this new engine of warfare will ever be brought to the test of the actual combat, and it is much more than probable that, even should this be the case, the French will in the meantime have abandoned melinite and its derivatives, which have already led to many very serious accidents. Whatever form of high explosive may be retained, or may be invented, it is in any case unlikely that it will be free from the very serious defect that an accidental explosion in the gun, whether it be caused by a defective fuze or by a defective shell (and neither shells nor fuzes can be always perfect), will almost certainly lead to the destruction of the gun by a violent and most dangerous explosion; setting aside the physical, the moral effect upon the collateral guns of such a burst will be most disastrous.

Some of you may perhaps have remarked that neither of the two Powers proposes to use the new shell against troops in the open, each apparently preferring to trust to the well-known effect of shrapnel. The cause of this decision is not far to seek, and may be found in the tremendous action of the high explosive itself. A shell so filled is on bursting broken up into a very large number of very small fragments, which are projected violently in all directions (or as we should say, the angle of opening is 360 degrees); few of these fragments are much larger than the finger nail, and their effect, devastating on the spot, is limited to a very short radius, while, moreover, a large proportion of them are thrown vertically into the air or

into the earth, leaving a comparatively small number to pass to the front into the ranks of the enemy. The result of the want of size, and therefore of weight, of the fragments is that they soon lose their velocity and energy, and are thus useless unless the shell be burst very close up to the target; it is no exaggeration to say that a man would probably be safe at a distance of 50 yards from the burst. If we compare this description of projectile with shrapnel shell, of which the bullets are effective to a distance of at least 150 yards from the point of burst, we shall see that the high explosive contrasts unfavourably with the latter in the following respects:—

i. Its effect on a deep target, such as a column of infantry or cavalry, or indeed any deep foundation.

ii. The fact that it will be necessary to burst it with a far greater accuracy than is required with shrapnel, with such accuracy, indeed, as is at present scarcely within the capability of the time fuze.

Under those circumstances we need not be astonished that the new projectile is intended, not to replace, but to supplement, existing shell; it remains to be seen whether its importance in war will be found to counterbalance the undoubted risk which, whether in war or peace, is inseparable from its use.[1] It is, moreover, obvious, as has been hinted above, that, since all high explosives are smokeless, it will be impossible to ensure the accurate observation of such fire, since no means will exist by which to judge of the position of the burst, and therefore of the efficiency of the shell.

Smokeless Powder.—The preservation of the secret of the composition of its peculiar kind of smokeless powder has been a matter of particular care on the part of every nation in Europe, but it may probably be said, speaking generally, that there is a very strong family likeness between them. I should not wish, even if I were competent to do so, to enter into a description of the chemical constituents or proportions of any of these explosives, but it may perhaps be of interest that I should describe the appearance of Nobel's "Ballistite," which is a fairly typical representative of the class; in doing this no indiscretion will be committed, since the powder in question is an article of commerce.

"Ballistite" is a semi-transparent gelatinous substance, of a colour varying from yellow to brown; it is made in sheets of different thickness, according to the nature of the gun for which the powder is intended; and these sheets are afterwards cut up into dice, the so-called powder being used in this form.

Though the subject of the composition of smokeless powder is rather dangerous ground, there can be no objection to considering the advantages to be derived from its use; these may be divided under two heads; viz.:—

a. The technical advantages.

b. The tactical advantages.

[1] In speaking thus I refer only to the use of high explosives *in the field*; under other circumstances, notably in the case of siege operations, it seems not unlikely that the advantages to be gained by their use will far outweigh the diminished risk which accompanies such conditions.

The principal technical advantages to be derived from its use are:—

i. A diminution in the weight of the charge, as compared with black powder; this renders it possible either to obtain the same effect with a lighter cartridge, or to increase the velocity of the shell without augmenting the weight of the charge.

Among Continental nations the tendency, up to the present time, has been to retain the old muzzle velocity and to diminish the charge to about one-third of the weight previously used.

It is evident that this diminution of weight will permit either of carrying more rounds in the limber and wagons, or, should it be preferred, of using fixed ammunition without adding to the weight behind the team.

ii. Greater uniformity of action than it has been found possible to obtain with black powder, leading obviously to more accurate and regular practice.

iii. Less fouling of the bore.

iv. Less recoil with the same muzzle velocity.

It is generally allowed, however, that further knowledge is needed with regard to two very important points; viz.:—

A. The keeping qualities of smokeless powder, especially under trying climatic conditions. This is, of course, the weak point in the smokeless sporting powders, with which we have been so long acquainted, and many of us so completely realize this failing that we do not keep cartridges from one season to another; we have again all experienced how untrustworthy are cartridges which have become even a little damp, while gunmakers will advise us not to use such as have been exposed for any considerable time to a heat of 100 degrees. It is evident that such characteristics would be fatal to the serviceability of a military powder, since all these contingencies must befall an explosive which is to be used in war; any new powder must, therefore, in order to have a claim for adoption, be able to resist them without any sensible deterioration.

B. Very little is known at present, since no one has had sufficient experience to form an opinion, as to the corroding or eroding qualities of smokeless powder. While some hold that the absence of solid particles in the gas as it rushes through the bore will tend to secure comparative immunity from erosion, others consider that the great heat which is undoubtedly developed by the combustion of all smokeless powders will have a fatal effect upon the interior of the gun; we may, I think, wait for time to decide this question, which, in any case, is not vital.

Should it be found, after the experience of some years under varying circumstances, that smokeless powder is as trustworthy as gunpowder (which was, as we know, by no means unaffected by heat and damp), the great technical advantages to be derived from its use would be sufficient, even if we disregarded the tactical benefits, to ensure its adoption, in some form or other, in every army in the world. It is at present, however, almost everywhere upon its trial,

and has, I believe, been as yet definitely adopted for field artillery by France alone of all the Continental Powers.

Should any of the various descriptions of smokeless powder now under trial in the world prove to be uncertain or undesirable, the Power which is affected by this failure will assuredly call in again the aid of science, and demand the solution of the problem, making, if necessary, repeated trials to obtain success; of one thing we may, I believe, be sure, namely, that a complete and reactionary return to our old explosive, gunpowder, is as impossible as is the re-adoption of bows and arrows for our national weapons.

b. The tactical effects of the introduction of smokeless powder.

Since this subject would alone afford sufficient matter for a lecture, you will not perhaps expect me to do more than merely suggest a few important points with regard to field artillery.

It is anticipated that the absence of smoke will permit batteries which carefully select their positions to open fire, and even to continue firing, without disclosing to the enemy their exact locality. When considering this point, a German authority has laid down that it will sometimes be necessary for the Officer commanding a battery which is so fired on by an unseen foe to place himself in prolongation of the graze of the enemy's shells, in order to obtain, from the direction of that graze, some guide as to the position of the guns from which they were fired; a refinement on this suggestion points out that, if high explosive shells are used (which burst immediately upon impact), there will be no trough by which to judge, and offers this as a reason for their adoption.

This attribute of invisibility has, I venture to think, been somewhat over-estimated, both as regards its extent and its effect.

As regards its *extent*, for the following reasons:—

i. Though the powder be smokeless, yet the discharge of the gun is accompanied by a very vivid flash (closely resembling the flash of a heliograph), and this flash it will be difficult to conceal in the case of guns which are laid over the sights, and which must be, therefore, except for some intervening cover, partially visible to the enemy. In some respects the flash is a better guide than smoke to the position of the enemy, since it shows (it is true, but for a moment) the actual position of his guns, whereas the smoke either hangs as a pall in front, or drifts away to one side.

ii. The existence of this flash necessitates, if invisibility is to be preserved, very great care in the choice of a background; while a good background, since it requires that we shall "see ourselves as others see us," is a most difficult thing to select.

iii. The amount and the great velocity of the gas which issues from the muzzle throws up from any ground which is at all loose or sandy (and almost all ground will tend to become loose when the guns have been fired a few times) a cloud of dust, which, though it is equal neither in volume nor density to the smoke of gunpowder, will yet offer a mark sufficient to show the position of the battery.

I am inclined to doubt the *effect* on tactics of this assumed invisibility, because it will, I believe, be found obtainable only at the cost

of efficiency, and will, therefore, be discouraged. I cannot think that that army will be victorious which thinks firstly of hiding itself, and only secondly of fighting, while we must further remember that only victorious armies lay down rules for war; no one studies the tactical principles of a defeated nation.

Again, speaking of Continental armies, the proportion of the artillery to the other arms has been so very much increased, while, at the same time, the actual size of the battlefield is practically regulated by the numbers of the infantry, that it seems probable that the great difficulty in the conduct of the former arm will be to find room for the mass of guns, and that thus all considerations, except those affecting the amount of injury that can be done to the enemy, will be allowed to lapse.

The absence of smoke will certainly materially assist the practice of the battery, inasmuch as not only will the observation of fire be easier, but there need be no delay in laying, since the target will be always visible. I need scarcely enlarge on this very obvious advantage; but there are others closely connected with it which do not strike one so directly.

Many of you will remember how constantly in the history of the Franco-German War we find mention made of the fact that when the wind was on a flank the smoke of the windward batteries tended to silence those to leeward, and how, in order to overcome this disadvantage, it was customary to increase the intervals between brigade-divisions, and also to arrange the several units in échelon from the leeward flank. At first sight, these remedies, especially the latter, appear sufficient, but we shall realize how different theory is from practice if we endeavour to apply them in the case of a large force of artillery, say the batteries of an Army Corps, on any piece of ground taken haphazard; it will frequently be impossible to make the guns fit in. We must, moreover, remember that such an arrangement could not in war be made beforehand (since no one could know which way the wind was going to blow), but must be improvised amid all the excitement and hurry of battle. May we not feel certain that nine times out of ten the remedy was illusory or insufficient?

The invention of smokeless powder has made us independent of any such complicated formations, and Officers are now at liberty to adapt their troops to the ground in such a manner as may best ensure their efficiency, without reference to their own or anybody else's smoke.

But the Germans have gone further than this; realizing how difficult it will be to find space for the masses of artillery which they propose to use in war, they have strained every nerve to find a way to increase the number of guns which can stand on a given space. In order to do this, they have reduced the interval between guns to fifteen (in some cases even to six) paces, but without diminishing battery or brigade-division intervals, which they consider necessary for the preservation of fire discipline.

In place of échelons, which obviously take up a large extent of ground in proportion to the number of batteries, they propose to use

successive lines or tiers of guns, and thus to crowd such ground as is available for artillery with the greatest possible number of weapons. Both of the above changes are entirely dependent for their inception, as they will be for their advantage, upon the fact that the new powder has no smoke which may hide the enemy.

IV. *Miscellaneous.*

I had hoped to be able, under this head, to say a few words with regard to material as affecting mobility, which, next to accurate shooting, is the highest attribute of good artillery, but I have found that to do so would open out a subject too large and too complicated for the present occasion, and I have, therefore, been reluctantly compelled to limit myself to—

(*a.*) The amount of ammunition carried in the field.
(*b.*) Armoured defences in the field.

Amount of Ammunition Carried.—If we compare the artilleries of France and Germany, as they now are, with the same forces as they were in 1870, we are struck at once by two points of difference: 1st, the enormous increase in the proportion of guns to infantry; and, 2nd, the great addition which has been made to the amount of ammunition which was then carried in the field. Upon the first of these I do not intend to touch, but the second comes fairly under the head of "Material," and calls for some remark.

The Germans have added two wagons and the French three to the establishment of each battery; omitting the increased storage due to an improved pattern of wagon, we may thus say that the former have added 33 per cent., and the latter 50 per cent., to their former equipment in ammunition. The Russians have gone even farther, and have now 12 wagons to the battery, exclusive of forge, store wagons, &c.

The following table shows the number of rounds (approximately), and the total weight of ammunition, carried by a battery of each of the Powers named.

	No. of shell.	Weight in cwt.
Austria—		
Horse artillery	912	81·4
Light field	912	81·4
Heavy field	768	102·8
France—		
Horse artillery	936	115
Field artillery	852	144
Germany—		
Horse artillery	808	119
Field artillery	808	119
Great Britain—		
Horse artillery	648	72
Field artillery	648	72

	No. of shell.	Weight in cwt.
Italy—		
Horse artillery	858	73·5
Light field	852	72·9
Heavy field	780	104·4
Russia—		
Horse artillery	840	108·7
Light field	900	116·5
Heavy field	648	154·5

Armoured Defences in the Field.

The accuracy and volume of modern fire, both of artillery and infantry, has led at various times to different suggestions, having for their object the protection of guns by some species of armour. These have, up to the present, been rejected in practice, owing to the unavoidable increase of weight which would be the consequence of the adoption of such a form of protection. Since, however, this desire for invulnerability is a sign of the times, it will be well to consider the latest form which such cover for guns in the field has taken.

This may be found in the Gruson travelling shielded mounting, which was tried at the German Manœuvres of 1889, and which was also exhibited to a gathering of Officers of all nations in September last at Magdeburg.

The mounting consists of a sheet-iron cylinder, which is provided with a floor and a revolving curved roof, and has a door at the rear. The weight of the gun (which is without recoil), and that of the roof are taken on a central column, and do not fall upon the thin iron sides. The system rests on four small rollers, which are used to place the mounting in position, while the transport of the whole is rendered comparatively easy by the use of a transporting axle, carrying two wheels. It is considered that the whole can be drawn by three horses, which are driven by a driver sitting on the cupola itself.

These mountings are made in three sizes, as follows:—

i. For a 1·46-inch quick-firing gun, which fires a 1 lb. shell with a velocity at the muzzle of 1,588 f.s.

The weight behind the team in this case is

Weight of gun.....	81	lbs.
Weight of mounting	4,188	,,
156 rounds of ammunition....	233	,,
Total.....	4,502	,, or 40 cwt.

ii. For a 2·09-inch quick-firing gun, throwing a 3·85 lb. shell with a m.v. of 1,624 f.s. The weights are as follows:—

Weight of gun.....	313	lbs.
Weight of mounting	6,834	„
130 rounds of ammunition....	662	„
Total.....	7,809	„ or 69 cwt.

iii. For a 2·24-inch quick-firing gun, which fires a shell of 6 lbs. with a velocity of 1,575 f.s. Of this, the weights are

Weight of gun.....	397	lbs.
Weight of mounting	6,393	„
80 rounds of ammunition	710	„
Total.....	7,500	„ or 67 cwt.

If we divide these weights by the number of horses which are intended to draw the gun and mounting, we find that the draught for each horse is—

i. 13·3 cwt.; ii. 23 cwt.; and iii. 22·3 cwt.

It follows from the above that these mountings can travel only on roads, and are not, therefore, in the true sense of the word, field artillery mountings; they may be of great use in defensive positions and in sieges, but they have not sufficient mobility to rank as field carriages.

It is intended that they shall be buried in the ground in such a manner that the roof and the gun are alone visible, and it is anticipated that they will thus be safe from injury owing both to their invisibility and to the shape of the curved roof, which will throw off shell travelling on a flat trajectory, while their small area will render it extremely difficult to hit them with high-angle fire from field howitzers or mortars. These claims are doubtless well grounded, and such defences would be very hard to see, and still more hard to injure.

On the other hand, the guns used in the mountings are of so small a calibre that it is very doubtful whether they would be of much value in the field, since, as has been already said, the common shell would carry but a small bursting charge, while the shrapnel could contain but very few bullets; it is probable, however, that the ring shell, the true projectile for quick-firing guns, might be of some practical use. It is, nevertheless, a question whether the protection given by the mountings might not be better employed in covering machine-guns, which, remaining invisible during the artillery struggle, would be available for use when the infantry attack developed, and would be entirely invulnerable to infantry fire.

These mountings might, as has been already said, be employed in defensive positions, in cases where such positions were decided on some time in advance of the struggle and deliberately prepared for a stubborn defence, but their true vocation is in the defence of fortresses, for which they are sufficiently mobile and in which, if armed with machine-guns, they might be of considerable use.

I have now, as far as the time at our disposal will admit, brought

before you the present general position of the material of field artillery, and have further endeavoured to point out the various directions in which progress appears to be about to take place; these may be summed up as follows:—

Universal use of smokeless powder.
Use of high explosives for shells.
Increase of the length, and therefore of the capacity, of shells.
Employment of field howitzers or mortars.
Increase of the muzzle velocity of guns.
Increase of the amount of ammunition carried.
Probable employment in the future of quick-firing guns.

In mentioning these, I have, I believe, selected for notice the most vital of the many questions connected with field artillery, but have, as many of my audience may doubtless remark, been compelled by the inexorable clock to omit such important matters as rifling, fuzes, tubes, sights, and laying, and, which I most regret, the subject of material as affecting mobility.

It only remains for me to thank you for the kindness with which you have received my unavoidably technical paper.

Mr. ARNOLD FORSTER: Perhaps I may say one word on this subject. What strikes me most is this, having very carefully read this paper and having heard it now, namely, how little we seem to have learnt from the experience gained in other countries compared with what might have been the case. One or two matters referred to in the lecture appear to me as excessively important for observation. The lecturer has referred to the question of high-angle fire. A short time ago I was at Okehampton and saw the firing with our two experimental howitzers which were taken there for their trials. I must say the trials at that time did not seem to me to do fair justice to the guns. The howitzers were fired against two 20-pounder experimental field guns, and they were fired not to strike objects on the reverse slope, but at objects facing the gun. Whether it may have been that the result was considered unsatisfactory or not I am not aware, but, as far as I am able to ascertain, very little has been done in carrying out the idea of high-angle field firing. At the end of last year I had an opportunity of seeing the practice with Krupp guns by the Swiss artillery when visiting the artillery practice ground at Thun. I have now seen a considerable amount of artillery practice, and when I recall the fact that these guns were many of them worked by volunteer gunners, not regular soldiers at all, the results of the high-angle fire with 30-pr. howitzers seemed to me something extraordinary. The range was from 2,000 to 2,400 yards, firing in all cases at unseen objects. Now it does appear to me that we are in a position in which practice of that kind would be even more essential than it is to the Swiss. It is easy to imagine cases in which we might be called upon to act, where we should be compelled to fire against a landing party, or against objects afloat where high-angle fire would be destructive and direct fire would be inoperative. I should like the lecturer to tell us whether anything is being done in this country to promote the study of high-angle field firing at unseen objects. It is clear to me, from what is mentioned in the paper, and from what I have myself seen in Switzerland, and also in Russia, that the system of high-angle fire is being carried out to a very large extent abroad. That brings me to another matter. The lecturer notices the uniform tendency on the Continent to lighten the carriage and limbers, and as far as possible assimilate all field guns to one pattern. In view of what I saw in Russia, I endeavoured to ascertain what would be our position with regard to the pattern of the gun for which we should have to find ammunition in case we were

engaged in any operations against a Continental Power; and, although I was prepared to find a certain variety of types, I was not prepared to find the extraordinary confusion which exists with respect both to service projectiles and service guns in India and in this country. I do not think, I must say, we are likely to suffer from one danger suggested by the lecturer, that of having our guns overcrowded. I think we should probably have always as much space to put the guns as they could possibly require.[1] Colonel Walford gives point to that observation by calling attention to the fact of the very large increase considering the normal number of guns per thousand men that is taking place upon the Continent, and he calls attention to the fact that a similar increase has not been made in this country at all. I do not know whether anything has been done with regard to another development of field artillery of which I saw an example at Moscow, that is, the adoption of the principle which we have in our own artillery, namely, the application of the plan of the screw gun to larger types of gun than those to which we are at present applying it. I saw a gun, one of the pair in use for a very long time at Plevna and which fired a very large number of rounds. It was a gun of a type very much larger than any ordinary field gun, but which, owing to the fact that it was divided into three sections and joined together upon the screw principle, was capable of being transported, and was transported where there was no railway carriage available, along with the field train and made use of in bombarding the entrenchments at Plevna. I can only say again the moral of the lecture we have heard to-day, which to me has been one of the greatest possible interest, is this—that with all this mass of information which has now been concentrated, and put before us, as far as I can make out from the study of the actual condition of our batteries,—both service batteries and what are supposed to be auxiliary field batteries—we have practically learnt no lessons from what has been done in that direction on the Continent. Major Walford spoke of the use of coal-dust in the French shell to distinguish the burst on graze. I do not know whether any attempt has been made to produce a similar effect of any of the high-dispersion shells by the introduction of any smoking product, or flaming product, which would give indication, by night and day, of the place of graze of the percussion shell.

Colonel WALFORD: There would be one great objection, namely, that it would take up the space of a certain amount of high explosive. That is, of course, the objection to using coal-dust as in the French shrapnel; for you must give up a portion of the bursting charge in order to put in some powder which may smoke, while this implies that you reduce the power of your missile.

Major W. J. ROBERTSON, R.A.: I should like to draw attention to one point. Colonel Walford says, "Some of you may, perhaps, have remarked that neither of the two Powers proposes to use the new shell against troops in the open, each apparently preferring to trust to the well-known effect of shrapnel." I am afraid I shall stand in a minority here and elsewhere; at the same time I should like to throw a doubt on this "well-known effect of shrapnel." I am not aware that it has been tried and found to succeed in actual warfare, and I am perfectly certain, with regard to horse artillery at least, if not in many cases with field artillery, that there are occasions when shrapnel will fail, either because there is not sufficient time to regulate and to set the fuze, or on percussion, because it has not many of the qualifications that a simpler filled shell with a larger bursting charge would have. This I think would be *more particularly* found with regard to firing at cavalry.[2]

[1] Some of the best of our so-called auxiliary field batteries have *one* wagon for four guns. Many other batteries have *none*. The guns, therefore, might, of course, just as well be in the Patent Museum, or at Madame Tussaud's, as far as any practical use in time of war is concerned.

[2] I here used the words "more particularly." Colonel Walford, in his reply, asked me if I did not attach too much value to the *rôle* of artillery fire against cavalry. I do not think I do. I attach, it is true, overwhelming importance to the cavalry that drives back its opponent in the initial phases of the struggle, but I have little faith in shrapnel when fired in great haste or feverish excitement, and I believe many rounds will come under one or other head of this category.—W. J. R.

During the late Cavalry Manœuvres in Berkshire we constantly were in action, drawn up in a certain place, expecting cavalry suddenly to appear. All of a sudden we got a glimpse of them. I am perfectly sure, if we had a man-killing shell of a simpler construction with a bigger bursting charge, we should do a great deal more damage than with shrapnel, either with a time fuze or percussion fuze. Then, again, you talk of moral effect, but, undoubtedly, to the cavalry soldier moral effect has a great deal to say. There is a great noise made by common shell bursting among horses; it upsets them and disturbs them. We look, as artillerymen, to the moral effect of artillery from our own point of view, from our end of the range. We forget the noise made by common shell bursting. I have mentioned before, and I may mention again, that once in India, in order to test the matter I took a horse, well known in the battery to absolutely mind no noise of firing. I took the horse into a covered butt, where he was quite close to common shell bursting, and it was absolutely impossible to hold him—the horse was frightened out of his wits. I am perfectly certain we should be wise if we paid more attention to issuing a shell in place of common shell, because it appears that the steel common shell which we use would be absolutely useless as a man-killing weapon; it would break up into far too few pieces to be of use. Therefore, I stand here to-day as a pleader for a man-killing shell, more in the form of a ring shell or segment shell, with large bursting charge. I have not had the opportunity of reading over the lecture previously. There are many points I should have liked to have spoken upon, but I do not feel sufficiently rash to speak upon them after simply having heard the lecture read.

Colonel WALFORD (in reply): The first remark made was with regard to the field howitzer and the practice at Okehampton. I was not at Okehampton during the year in question, but I saw the whole of the record of the practice, and I know, as a matter of fact, that what was attempted there was to test the comparative value of howitzers and 20-prs. in breaching a parapet. I confess that I think all shell which are employed in breaching parapets are absolutely thrown away. The enemy puts up a parapet with the object of inducing you to fire at it and not at him, and I consider that the proper way to use your gun is to endeavour to kill men and not merely to injure material. I think that we have in the past made a great mistake throughout, in field artillery, in siege artillery, and in coast artillery, in that we have persisted in trying to break through and destroy inanimate matter, instead of giving our whole mind to killing men. There is no greater mistake, in my opinion, than to use a howitzer to shoot at a parapet; you want rather to hit the people behind the parapet. For similar reasons I should never attempt to destroy a gun-pit with common shell, but should strive to kill the gun detachment without expending time in destroying the gun-pit. With regard to the practice of the Swiss artillery, I was present at the Swiss Manœuvres in 1889, and also at their practice at Thun. At the time I first saw them they had been eight days in training, not having been out previously for two years. I have no hesitation in saying that I have never seen better practice. In the last number of the Journal I published a paper, which was sent to me by Colonel Schumacher, the Chief Instructor of the Swiss Artillery, on the subject of practice carried out in order to ascertain the effect of artillery fire on different formations of infantry, cavalry, and artillery; if any one of you will read the record of that practice, you will say, I think, that some portions of it are as good as anything you have ever seen in the matter of time and in rapidity of fire, while the effect was very remarkable. This I believe to be, to a great extent (and perhaps Major Robertson will be glad to hear this), due to their use of ring shell. I saw one case, where 6 ring shell and 12 shrapnel were fired at 40 infantry at a range of 1,830 yards; these 18 shell gave 936 hits, or 52 hits per shell. Of the 936 hits about 200 were due to the 6 ranging shell, of which only three were effective, since the others burst beyond the target. After such results very little can be said against ring shell. With regard to whether we ourselves are trying any form of howitzer, I may say, that we have, at the present moment, a quick-firing howitzer under trial, but whether it will ever be introduced for field artillery I can offer no opinion. I think that Mr. Forster suggested that I should make some comparison between the work that is being done on the Continent and the work that we are doing here. I am afraid, much as I

should like to make comparisons, that I cannot very well, in my present position, do so in public. I have carefully avoided, in the whole of my paper, making any comparisons; I have stated all the facts I possibly could, and left the comparisons to you.[1] With regard to the "screw" gun, Mr. Arnold Forster mentioned that the Russians had a screw gun at Plevna. The only gun of which I have any knowledge was an 8-inch gun, which was used during the siege of Rustchuk; this was a screw gun, and was capable of division into three parts. One thing particularly struck me in the report of this gun; it was said that it had only been tried at short ranges, never having been fired over 5,300 yards; that appeared to be a very fair range. I may say that I think we have a better system for large guns than that then used by the Russians. We had a gun in use last year which can be taken to pieces without any difficulty, and which is on a stronger system than the Russian. I am not at all sure that Mr. Arnold Forster is not a little disposed to over-estimate foreign artillery as compared with our own. I am inclined to think that, so far as material goes (I do not say projectiles), but as far as the gun and carriage are concerned, we are ahead of the rest of Europe; I do not state this with any particular desire to claim perfection for our equipment, and I should deprecate any cessation in our efforts to advance, but I feel that the rest of Europe is knowingly behind the times, and I think that the majority of their guns are really obsolete.[2] Major Robertson spoke of the effect of shrapnel. It is perfectly true that shrapnel has not been tried in war, and I quite understand the objection to the use of time shrapnel, as requiring time and also great steadiness in action. He desires some other projectile to use against cavalry. I do not know exactly how to put my meaning, but I would ask Major Robertson himself (perhaps that will be the fairest way), whether in this, as in other points, he does not think, perhaps, a little too much of horse artillery, solely in connection with cavalry. After all, if we cannot beat cavalry with horse artillery, there is more important work for horse artillery to do. We can beat infantry; if we can get the best possible projectile against infantry, we should, I think, be prepared to let the cavalry take care of itself; or, if we cannot do better, then to wait until the cavalry come within case range. I do not think I would alter my projectile, if it were effective against infantry, for all the cavalry in the world. A battle, after all, is won by infantry, and it is the infantry which the artillery must stop or beat down. I should agree with him that, if you are compelled to fire percussion shell (and there undoubtedly are circumstances under which you *must* fire percussion shell), that you would do better with ring shell than with percussion shrapnel, and I should myself prefer to have a ring common shell and a shrapnel shell with the burster in the base. This, however, I give only as my personal opinion, and I fully realize that a very large number of Officers, for whose opinion I have a very high esteem, are totally and entirely opposed to both these suggestions. I do not feel entirely convinced that the effect of percussion shrapnel would not be sufficient against cavalry, even putting aside the question of the introduction of ring shell; for this reason, that in my experience, and, I believe, in that of most others, percussion shrapnel is generally used under the most unfavourable conditions, that is to say, it is employed either against troops under cover, such as a shelter trench, for which it is wholly unsuited, or it is used against a line of skirmishers in the open, or a line of dummies in the open,

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[1] It has since occurred to me that the audience may have presumed, from my words, that I intended to imply that such comparisons, had they been made, would have been entirely to our disadvantage. This was not at all my meaning, nor is it by any means the case. The reason for my reticence was that, in order to make a full comparison, I should have been compelled to make public matters which are still in an experimental stage. No one realizes more clearly than I the astonishing advance which our field artillery has made during the last five years.

[2] Our 12-pr. gun and carriage are, in my opinion, in advance of those at present used by any other nation, and mark, in some degree, the direction in which the progress of Continental artillery material will take place. So far, this is satisfactory; but we must take care that, when the great artillery re-armament takes place, we are not left behind to an equal degree.

for which again it is wholly unsuited. If, however, you take cavalry soldiers on their horses, averaging 8 feet in height, and put them in two ranks, in the front of a troop or of a squadron, and burst a percussion shrapnel on graze 15 yards short of that front, you will, I feel sure, make a very considerable hole in that troop or squadron. I have never seen percussion shrapnel tried against what I should call a fair cavalry target. There are, I believe, no other points which call for remark from me.

General J. T. WALKER, C.B., late R.E.: It is much to be regretted that we have so small an audience to hear this very excellent paper. It happens, unfortunately, that the day chosen is one on which it is not usual to have lectures delivered in this Institution,[1] and it also happens to be the very day on which a lecture on some subject of the same kind is taking place at Woolwich: therefore, there are not as many persons here as one would like to have been present to have joined in the discussion, which is usually one of the main features, and one of the most interesting parts, of the proceedings. I think, therefore, I can do no more than convey your cordial thanks to Colonel Walford for the excellent paper which he has read to us, and I hope that it will lead, in the long run, to the extension of the amount of ammunition with English batteries, which he has shown in one of the valuable tables illustrating his paper is so lamentably short of the amount that is furnished to all the batteries in Europe. I am sure you will all join in giving Colonel Walford your best thanks.

[1] The day was chosen to meet the convenience of the lecturer.—Ed.

Wednesday, February 18, 1891.

GENERAL SIR C. P. BEAUCHAMP-WALKER, K.C.B., Vice-President, in the Chair.

ATTACK FORMATION.

By Colonel G. UPTON PRIOR, late Commanding 2nd Battalion The Royal Scots.

PART I.

IN discussing the question of an attack formation, it is not possible to do so without introducing into the argument the formations in vogue at the present time, and this I venture to hope will be considered a good enough reason for the prominent way in which the attack formations laid down in the present Field Exercise are mentioned. Though it will be seen that the criticisms are not favourable to the formations themselves, they are to the excellent maxims laid down in the Field Exercise, on which those formations are based. These maxims will be found in the chapter on Tactics of the Field Exercise, Part 6. The formations are only introduced as being the latest extant, and as the most convenient way of approaching a subject which, though looking simple, is really difficult, justifying the remark of Clausewitz that "everything in war is simple, but what is simple is difficult."

As the Field Exercise is, I believe, having a few alterations made in it, and the attack formation may, I presume, be looked upon as virtually dead, it will be for the public good if we use them as a lesson for any future formation, and the present seems a favourable opportunity for any discussion on the subject. I would desire to say how much I am indebted to the "Letters" on Infantry, Artillery, and Cavalry, by H.S.H. Prince Kraft zu Hohenlohe-Ingelfingen, translated by Lieut.-Colonel Walford, Royal Artillery.

With these introductory remarks I will proceed with the argument.

The question of the formation most suitable for infantry to adopt when attacking has always been of vital importance to the success of an army. This formation has ever been a varying one, depending chiefly on the great factor of the "arms of the day"; there were dense masses in Continental armies and rigid lines in the English with unrifled arms, and a gradual shaking out of such formations into finer ones when these arms improved. As the Field Exercise of 1890 justly remarks, "Normal tactical formations have a real absolute value, and when adapted to the configuration of the ground, and to the nature and condition of the troops, seldom fail to influence

favourably the issue of a contest." The Field Exercise also gives the conditions on which now-a-days all formations intended to be used by troops, attacking a disciplined and well-armed enemy should be based.

These conditions are:

(1.) Admit of the most efficacious fire at all times, and of its greatest development at the decisive moment.

(2.) Present a difficult target to the enemy's fire.

(3.) Allow of the best use of any cover that can be advantageously made use of.

(4.) Afford the greatest mobility at all times.

(5.) Admit readily of reinforcement.

(6.) Lend themselves to the maintenance of command.

Our first duty is to consider whether these conditions represent correctly and adequately the requirements of the present time.

Now evidently the main factor which has been kept in view in framing them has been that of the arms of the day; Nos. 1, 2, 3, 4, 5 conditions all point to this.

But so quickly do changes occur that, even since the above conditions were written, arms have improved, and other factors besides arms have arisen, which might necessitate fresh conditions. These are:

1st. The tendency to employ cavalry in masses, a subject on which we have had the advantage of a valuable lecture at Aldershot lately.

2nd. The invention of a smokeless and a possibly noiseless powder.

We must also recollect that in the English Army there is always the posibility of fighting badly armed fanatics. This, however, is not a new factor.

We may take it then that the two factors given above, with that of the Arms of the day, are the three great factors regulating the conditions of any attack formation; and a safe, and I trust not a tedious, way of considering the question would be to treat each of these factors separately, seeing first, if any of them require new conditions, besides the six laid down in the Field Exercise; secondly, to test the Field Exercise formation both with its own conditions and with any such new conditions if found; and, thirdly, to frame an attack formation suitable to them.

Taking the factor of arms of the day, these are rifled artillery and the magazine small-bore rifle. The artillery is pretty much the same as it has been for the last few years, and very powerful, indeed, are the field guns, the only practical limit to their range being the powers of vision. The small-bore magazine rifle is quite a new weapon, its speciality being a very flat trajectory with great powers of penetration.

Now, armed with a rifle like this, what sort of formation would it suit us to fire at? Evidently one with a good depth, in which there are a good many rows of troops behind one another, for then if a bad shot were made, it would matter little if the bullet went to the right or left of the man aimed at in the first row, and thus through

a gap in that row, because, if the elevation were good, it would go on and hit someone in a row behind; whilst if the shot were a good one, it would hit not only the man aimed at in the first row, but, going through him, might hit someone in a row behind, as I am informed that the flat trajectory ·303 bullet will go through six men or three horses. A story given by Prince Hohenlohe-Ingelfingen shows the power even of the rifle the Prussians had in 1870; he says that at St. Privat the glacis was in front of the village of Ste. Marie, which was rather advanced on the right flank; out of this village a flock of frightened sheep burst, crossing the front of the Prussians as they were about 600 yards off; the Prussians thought from the dust the sheep raised that they were cavalry, and shot every one of them. As regards artillery, though its effect is not so important in an attack formation as elsewhere, because the artillery of the defence is generally silenced early, it is a well-known fact that it is the density of the formation which is the greatest cause of loss to troops under its fire; the ground covered by the bursting of a shell being far greater in depth than in width. Both these weapons, then, which constitute the factor of arms of the day, would inflict frightful slaughter on troops drawn up in successive rows, and as such an eventuality does not seem to be sufficiently considered in the six conditions laid down in the Field Exercise, we must add this condition to them, viz.:—

When troops are under fire no two lines should advance together within 200 yards of each other.

Let us now consider the second factor of the tendency to employ cavalry in masses.

The massing of cavalry at peace manœuvres has been largely carried out of late by Continental nations, especially by Germany, Russia, France, Italy, and Austria all following in the same line, and even we ourselves have dared to spend 3,000*l.* on such manœuvres, and are thinking of having some more in three years' time, if we then have the money. Whether this change in the handling of cavalry has a strategical or a tactical object, it is difficult to say, probably the former chiefly. Now, as the German cavalry in 1870, departing from the custom of war in those days in like cases of sticking close to their infantry, suddenly developed the new *rôle* of boldly advancing miles in front, and spreading over a large area of country, thus securing to their own side the greatest strategical advantages, why should not the Germans, or any cavalry in the next great war, suddenly develop some trait hitherto looked upon as absurd, which might give to their side great tactical advantages?

The Germans commenced such tactical action on the 16th August, 1870, at the battle of Vionville-Mars-la-Tour, when, having only one Army Corps, their IIIrd, against three French Corps, the IIIrd, IVth, and VIth, they were obliged to use some 8,000 cavalry as second line to their infantry, until infantry reinforcements arrived; the cavalry acting as second line from 10 to 12 o'clock in the morning; and later on, the most of them, making with others a total of 78 squadrons, were moved to the Prussian left, to check the

advance of the IIIrd and IVth French Army Corps, who were making a flank movement against the Prussian left. Masses of cavalry were also used by the French three times, viz., at Wörth, Mars-la-Tour, and Sedan.

If it is found, then, that, despite the powers of rifled artillery and magazine small-bore rifles, a cavalry leader, making use of the ground and seizing on occasions when troops are exhausted, dispirited, or without ammunition, should hurl his masses against them, we should have a great tactical advantage for the side on which are such dashing cavalry. And it must be recollected that the cavalry of the defence have a much better opportunity of charging during an action than those of the attack, because they know the ground beforehand, can be placed ready waiting, and they have not so far to go to get to a flank.

The following examples show what cavalry have done formerly in action.

In days gone by, many more victories were won by cavalry masses than in later days; thus, the battle of Rossbach was won entirely by cavalry.

In 1866, at the battle of Custozza, two Austrian cavalry brigades, strength about 2,500 men, charged two Italian divisions, strength about 20,000 men, breaking through the skirmishing line and squares and creating such a panic that these divisions were useless for the whole day; at 5 P.M. they charged the same infantry again, and took 1,000 prisoners. And this was in a country more close than open, having many trees.

At the battle of Koeniggratz, a squadron of Prussian cavalry surprised a victorious Austrian battalion as it was advancing, and took the whole of them prisoners, some 600 men.

At the battle of Sedan, the divisional cavalry of the Germans continually charged in individual squadrons, and patrolled and reconnoitred during the fight.

On the 16th August, 1870, at the battle of Vionville-Mars-la-Tour, General von Alvensleben, wishing to gain time for the sixth division of the IIIrd Army Corps attacked by a very superior French force, ordered Bredow's brigade, consisting of six squadrons, some 800 men only, to charge, and they rode down the first line of the infantry of the whole corps, and then went on and cut down the teams and detachments of the artillery, checking the entire corps for the whole day, and virtually saving the day.

The subject is a deeply engrossing cavalry one, but in considering any attack formation we cannot enter further into it than to take it into our calculations as a possibility, and as such to make our plans beforehand against it. The great powers of the new rifle come to our assistance in this; we have both a rapidly-firing weapon and one which covers the first 500 yards of ground without any change of sights. And we must use these powers against this possibly new tactical action of cavalry. To take advantage of the rapid fire, we must have as large a front as possible for any close formation (we will call them here squares) against cavalry. Another advantage of having

large squares is that it brings the natural fears of the horse on our side; for horses are not machines beyond a certain point, and though they may be driven over infantry scattered in groups, or even over small sectional squares, yet they will not face any formation with a front big enough to show a good fringe of bayonets, because they can see that a long way off, even if they are going at a gallop; and they will then naturally open out, and go round the flanks, whilst the few who are driven into the square will be absorbed by it. Again, as cavalry never charge in a single line, but with a second and third on the flanks of the first, small squares, though they may resist the first cavalry line, would probably be broken by the flanking ones. Therefore, no square should be smaller than that of a company.

To take advantage of the power of the flat trajectory, and thus enable our men to fire at cavalry a long way off, we must have a clear field of fire; therefore, we must take care that our men are not in each other's way. This flat trajectory power disposes of the argument that large squares would suffer from artillery fire. A smart infantry should not do so now, for, with smokeless powder, cavalry would be seen a long way off; they cannot now pretend to charge, stopping three or four hundred yards short, directly they have got the infantry into squares; the infantry would now fire at them, and they would lose as many men from the infantry fire as the infantry would lose from the artillery. If the cavalry carry out the charge, their artillery must stop firing when the cavalry are within 400 yards of the square. A smart infantry need not then form square till the last moment; it can lie down when formed, and it can open out directly the cavalry commence to retire. It may be stated here that, in the campaign of 1870, the greatest number of cavalry charges against squares took place at Sedan, and were, as a rule, failures, though the French cavalry rode most gallantly. We therefore obtain from this factor that "no square, meaning any close formation, should be smaller than that of a company."

The third factor is smokeless powder, and its effect would seem to be as follows:—

(1.) The infantry of the defence, through being able to open fire without being themselves seen, could often inflict such sudden slaughter on the infantry of the attack as to render it liable to panic.

(2.) Both sides will not only be without the excitement caused by noise and smoke, but will be able to see and hear most clearly all the horrors of the battlefield. The nerves of both sides, and especially those of the attack, will be much more highly tried than they were in the old days. Fire discipline will be more likely to go to pieces; troops will not aim, but will fire anyhow, even without putting their rifles to their shoulders, or up into the air as if they were firing a *feu de joie*. Prince Hohenlohe-Ingelfingen remarks, "How difficult it is in the excitement of battle to teach infantry to attend to words of command and cautions, as to which target, with what sight, and with what description of fire they are to act; and, moreover, to accustom them to cease firing when they have expended the stated

number of rounds! It is asking very much of a man who is under the enemy's fire to expect him to cease fire in return for a certain space of time. A fire which has once commenced gets easily out of hand unless an 'iron discipline' prevails. It is so natural, so human, that the soldier should find comfort in the noise which his rattling rifle makes. The less a man is trained the more he is inclined to *shoot up his pluck*."

Consequently, one effect of smokeless powder will be to make the men lean more than ever on their Officers, or, in other words, discipline, and the strictest discipline, is more than ever necessary.

No. 6 condition of the Field Exercise partially provides for this, but we might add the following words to it:—"So as to ensure the strictest discipline being maintained."

Summarizing the results so far, we have the above addition to No. 6 condition of the Field Exercise, and two new conditions, viz.:—

From the factor of the arms of the day, "No two lines to advance together within 200 yards of each other under fire;" and—

From the factor of cavalry in masses, "No close formation to be formed against cavalry smaller than that of a company," if it can be avoided.

Let us now test the attack formation laid down in the Field Exercise by these conditions; and in doing so, let us assume that in considering any attack formation, the case of a battalion acting by itself be thought exceptional, and be treated as such; and the argument be based on the broader unit of a brigade, because no smaller force than a brigade could be detailed to act with any hope of success against a point chosen as an objective in a hostile position. Plate 37 of the Field Exercise, being seemingly a typical brigade formation of attack, is taken as the representative one, the battalion in its first line being distributed as laid down in Plate 36 of the Field Exercise; this formation is shown in the wall diagrams coloured red. There are two, one showing the attack at 1,000 yards from the position; the other at 450 yards. For the sake of comparison, Diagrams 1 and 2 are taken at the same distances; whilst Diagram 3, Plate 3, shows the attack at 50 yards from the position.

Proceeding to test this formation, and taking the conditions one by one, No. 1 condition we can see, by simply looking at the diagram, is fairly fulfilled.

No. 2 condition, "formations should present a difficult target to the enemy's fire," may be considered with condition No. 7, "no two lines to stand up together within 200 yards of one another under fire."

A mere look at the diagram shows that they are not fulfilled, as even at 1,000 yards the target offered to the enemy is a very easy one, whilst at 450 yards it is much more so, especially to aimed infantry fire, as the mass gets denser and denser the nearer they approach the position. Not only are there two lines of men behind one another, but probably half-a-dozen, because, besides the firing

line, the supports, and the reserve of the first line, we have a number of men continually running up between the supports and the firing line, and as the advance of these last men is at the will of many different leaders, it is likely to be very irregular.

No. 3 condition to "allow of the best use of any cover that can be advantageously made use of," is fairly fulfilled.

No. 4 condition, of "affording the greatest mobility at all times," is not fulfilled, if the term is applied, as it is presumed, to the mobility of formed bodies, for the men are so scattered in small sections and commands, that it would be very difficult to get them together for any combined action. And this point is particularly important in a field free of smoke, when not only the Captains and the Colonels can see, but even the General of the brigade, division, or army corps. The General may, at any minute, receive information, perhaps from a balloon in rear, enabling him to make determinations and decisions. For instance, in the case of a counter-attack, or of orders for the use of machine-guns, or in the case of his being obliged to use his infantry to help the artillery advance, or his artillery to help the infantry advance, or even of a retirement or reverse. The Colonels again, in the firing line, may have to give orders about an attack by cavalry, or to make certain companies lie down to let artillery fire over their heads. The Majors and Captains may have orders about the "Cone of fire," &c., &c. For any such special objects requiring the power of using commands quickly, the men must be well in hand.

No. 5 condition is to "admit readily of reinforcement." Now the plan adopted in the Field Exercise may be suitable for a battalion, but hardly seems so for a large body like a division or army corps, where there would be many battalions in a line, as it would interfere greatly with the regularity of the advance. Taking even the case of a brigade, it will be noticed that until the supports are absorbed in the firing line there are no less than sixteen points from which reinforcements keep on arriving in the firing line; and after this has occurred, there are eight points, viz., one from each company in the reserves. Now, everyone here will have often noticed how the arrival of one man, with a wrong interval in a skirmishing line, will make the whole line wave. A regular steady incline does not matter much, but it is when the waves are first one way and then the other that irregularity is caused. In the present case we have numbers of men continually arriving from sixteen points, which, with irregularity of ground and losses, must cause waves both ways. Of course this will be neutralized to a certain extent by each company advancing as it does by its centre, but not entirely. When the reserves commence reinforcing the firing line, we may have a half-company of one company and a section of another in support side by side.

No. 6 condition, that "formations should lend themselves to the maintenance of command, so as to ensure the strictest discipline being maintained," is a most important condition and worth going into.

The first words that come across our mind are those of paragraph 15,

section 7, of the Queen's Regulations, under the heading of "Chain of Responsibility," which reads as follows:—"Nothing more essentially tends to the maintenance of regularity and good order than that system or chain of responsibility, which should extend from the highest to the lowest grade." No words could more clearly convey the conditions necessary for the maintenance of discipline, and the experience of ages has proved their correctness. Is there a proper chain of responsibility amongst troops extended like these? Do the Officers who have commanded in peace, and whom the men are accustomed to obey, exercise that control in the fight during its whole stage that they ought to? Do they have their own men collected under their own command? Does the General command his brigade, the Colonel his battalion, and the Captain his company? Certainly not, for from the very moment the battalion breaks into attack formation, the commands are scattered, going from the hands of their natural leaders, the Colonel and the Captain, into those of the section leaders. The General would find it very hard to get his brigade to carry out any order quickly; the Colonel would be similarly situated; whilst the Captain has his company in three detachments with a front of 100 paces and a depth of 200. The chain of responsibility does not extend down; it is *broken*. Later on, when the battalion gets to within about 400 yards of the position, the supports, if one happens to reinforce more than another, might for some time consist of half companies of different companies. There is too much dispersion and mixing up even for peace, and the following examples show what it might be in war.

At the battle of Vionville-Mars-la-Tour, men were so mixed up that the only unit of command preserved at the end of the day was a regiment (viz., a brigade with us). At the battle of Gravelotte and St. Privat, almost all the regiments were fighting side by side in compact masses; at the farm of St. Hubert alone, 43 companies belonging to eight different regiments were crowded together. Now as a German company numbers probably some 170 men after they have been in the field a few days, the number of English companies, under the same circumstances, probably about 60 men each, that this would make is open to calculation. Some writers quote the above example as an argument in favour of the loosest formation, but the fact seems more as if the Prussians had rushed from the extreme of a very close formation to the opposite extreme of too loose a one. It is seemingly a fair conclusion then that the dispersion of command in such a formation as that of the Field Exercise cannot be conducive to control over individual men in a moment of panic, or when nerves are unstrung, or to that "iron fire discipline" we have shown as being so necessary.

No. 8 condition is that "no square smaller than that of a company" is to be formed. This condition could not be fulfilled, as, owing to the distance of the firing line from the supports, company squares could not be formed quick enough. Looking at the red diagram, the formation is seemingly such as to tempt the most peacefully dispositioned cavalry leader to attack. Not only are the men, from their entry into

the first zone, scattered about in bodies too small to be plainly seen a good distance off by horses rapidly advancing, but they are so placed in each other's way and in the way of the bodies behind, that if any fired they would be as likely to shoot each other as the cavalry. Cavalry might safely charge into such a mass of small units without much danger to themselves, and with a very good chance of cutting up the small bodies and creating a panic.

Summarizing the results, the Field Exercise formation fulfils Nos. 1 and 3 conditions, partially fulfils No. 5, and does not fulfil Nos. 2, 4, 6, 7, and 8.

There is another point in the formation which would have a most important bearing during an action, and which has not been touched upon yet, and that is the plan laid down for the direction of the advance. Though there is a "company of direction" to regulate the pace, yet there is no one directing point; each company marches by its own centre on an objective point of its own; thus, without entering into the larger question of an Army Corps or Division, we find that in a brigade we have eight different lines of advance before the reserves have reinforced the supports, and when all the reserves are absorbed in the firing line we should have sixteen lines of advance, viz., one for each company. Taking eight lines even, it is not likely that these eight lines of advance have been exactly parallel originally, but supposing they were, and the ground like a billiard table, with well-marked objective points on which to march, the manœuvre would not by any means be an easy one. But when the advance is to take place under fire, over ground probably undulating, in crossing which the files of direction and N.C.O.'s supervising them must occasionally lose sight of their objective points, to say nothing of the confusion caused by obstacles, as ditches, small spinneys, hedges, or perhaps foggy weather, and of the advance being continually interrupted by losses, and the arrival of reinforcements in the firing line, I think enough has been said to show that the chances of the eight lines of direction either crossing or going away from each other, with the consequent jamming or overextending of men, is more than great, it is quite impracticable.

Another criticism of a practical nature, seeming worthy of notice, is that the present attack formation is too intricate for an army composed of such heterogeneous materials as ours. It must be recollected that it is the attack formation not only of the Regular Army but also of the Militia, the Volunteers, and of the Indian Army; and that the Reserve Forces have few chances of practising it, whilst in the Indian Army there are a very small number of British Officers present with the battalion. From the first moment when the companies move forward, and have to divide the front, "taking up such position as will enable them, when their two sections are extended to three paces interval, to cover the same front as the first line would occupy were it deployed into line," to the later periods of the attack, when the bringing up of reinforcements accurately into the gaps of the firing line, which with the least undulations, sprinkling of brushwood, or foggy weather, are most difficult to see, the leading

of the men requires Officers and N.C.O.'s of some experience. And this would be felt more in war, when any day the formation might have to be taken up *most quickly* on unexpectedly falling in with an enemy, as in 1870 at the battles of Spicheren and Wörth. A simpler formation, and one more approaching the Line with skirmishers in front, the formation so loved by British troops, in which they have performed such gallant deeds, and which we know suits their temperament, would I think be better could we get it.

Part II.

The formation submitted to the meeting attempts to carry out this idea, and at the same time to fulfil the conditions of the Field Exercise, and the new ones we have framed; it is not submitted in any way as being the best attack formation; the only part of it that has been tried practically is the "Advance by ranks," and a field test is after all the only real one. Seemingly any attack on these lines will keep the men more than under the control of the Officers, especially of the senior Officers, and will combine discipline, solidity, and mobility with individual action.

Before entering into the formation let the following be permitted:—

(1.) When under fire, let the proper position of every man be, as now, lying down; this is not to mean creeping or crawling about.

(2.) Let there be no *proper* front rank nor rear rank; let the term "front rank" mean the rank that happens at any time to be in front, and the term "rear rank" the one that happens to be in the rear. Thus the ranks may change at any minute by the rear rank going through gaps in the front, and the rear rank becomes the front rank, and so on.

(3.) Advance *without firing* by ranks.

When men are lying down under artillery fire, and are required to advance without firing, it will be conducted thus: The Company Commander, Major or Captain, we will call him Captain, will blow his whistle, and, according to the nature of the fire, either double or run through both ranks, the men of the front rank turning over on their left sides on the sound of his whistle. The Captain will advance not more than forty yards, followed closely by the *rear* rank, who will each pass on the right of his front rank man. On the Captain throwing himself on the ground, the rank following him will pass him and throw themselves down about five yards in front of him, so as to allow room for the other ranks to lie down between them and the Captain. This will be the signal for the rank left lying down, and for the supernumerary rank, who will both be watching, to rise without orders, and, either doubling or rushing forward, to lie down behind the rank that has followed the Captain. Thus only one rank is under fire at the same time; and one bullet will not kill two men. The advance will be continued in this manner. If the fire permits it, the double will always be used and not the rush. If it is

thought preferable, the rear rank instead of lying down exactly behind the front rank can lie a little to one side behind the intervals.

Advance Firing.

(4.) When men lying down under fire are to advance firing, the then front rank *only* will fire, the then rear rank will not fire. The Captain will give the command for as many men to fire as he thinks necessary; the command will be given to the front rank by the section leaders in the ordinary way. Directly it is is carried out the Captain will blow his whistle, run through both ranks followed by the rank which has not fired; and so on as in the advance by ranks without firing.

Thus the fire of the rank which fires covers the advance of the rank which has to rush to the front; and even if there is no smoke the bullets disturb the aim of an enemy just as the men advance. The reason of waiting for the ranks to get together before firing is that it gives the Captain about half a minute to consider his next order, it gives the rank which has just rushed a little time to get their wind before firing, and it brings up the supernumerary rank to command the next firing. Tactically, the advantage of an advance by ranks is that it keeps the men in two ranks, and thus enables the company to be kept well under the control of the Captain and section leaders during the whole advance. It also leaves no doubt as to which part of the company is to advance, as in each advance the whole rank has to go. When different portions are detailed at each advance, there is often confusion and doubt as to who is to move.

Form of Attack.

In drawing out a Form of Attack, the first point is to fix the positions of the four battalions composing the brigade. Let two battalions go into the First Line (see Plate 3, Diagram 1), one into the Second, and one into the Third. The front of the Brigade will be determined by the front of the Second Line in rank entire, because that is the front with which we mean to assault the position. Thus, in peace or war it will be ever varying, depending on the number of men actually in the ranks. In peace-time, when battalions are weak, it would be advisable to consider the Second and Third lines imaginary forces, and that the strength of the Second Line was equal to that of the battalion on parade; the front this last should attack would then be half the front of the Second Line in rank entire, because in a Brigade there are two battalions in the Firing Line. In the present problem, for war the battalion is 800 strong, but we must deduct losses in the advance, say 50 men, which makes 750 men, and a battalion of 750 men in rank entire covers 750 paces. As we wish to give the men plenty of room to use their bayonets in the charge, let us add 50 paces to this, which, together with the room obtained by casualties occurring in the charge, ought to be enough. The front of the Second Line is then 800 paces.

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The Firing Line of the two battalions must then cover 800 paces. If each battalion sends 2½ companies into the Firing Line, we shall have 5 companies in the Firing Line, which in file extended to 3 paces, gives a front of 750 paces. Let us make the battalion intervals 20 paces instead of the 12 laid down in the Field Exercise; adding this to 750 makes 770, which, with four company intervals of 6 paces, namely, 24 paces, makes 794 paces, quite near enough for practical purposes to 800. Each battalion will have half a company in support some 20 yards in rear of the outer flank, and one company on each flank between this half-company and the Reserve. The remainder form the Reserve.

Each battalion in the Firing Line, then, has its right half-battalion in the Firing Line and Supports, and its left half-battalion in Reserve.

At first sight, the weak part of this formation is the long front, 150 paces, given to each company in the Firing Line; but it must be borne in mind that, even with this front, the company ought to be in hand, as it is all in front of the Captain, who, in the centre of it, is only 75 paces from either flank. With good section leaders, and probably little smoke and noise, it ought to be well in control. But as a fact, these fronts are all calculated for the strength with which battalions take the field, and are all too big. It would be Utopian to expect that a Captain, starting on a campaign with 100 men in his company, would have that number in his ranks on going into action; if, after deducting casualties, he has 70 men, exclusive of non-commissioned officers, &c., he will be very lucky; the front of 70 men at 3 paces is 105 paces. Even this front is only the front of the company on first forming for attack, which must decrease regularly at each advance.

The third battalion forms the Second Line, and the fourth battalion the Third Line. We thus have the formation of the Brigade. Whilst passing though the first Zone, the Brigade may be marching in column of route; on debouching from this, probably about the commencement of the second Zone, the battalion commanders will receive orders from the Staff to "form for attack as a right battalion or left battalion." The Brigade-Major will show the Commanding Officers the objective point, and the Brigade will extend. Should, however, the Brigade pass through the first Zone in line, or in line of column at deploying intervals, the front of each battalion can be covered by skirmishers and supports in the ordinary way, each battalion sending out two companies to skirmish, each company detailing half a company to skirmish and half a company in support. In this case, on the brigade order to "Form for Attack" as a right or left battalion being given, the two companies sent out by each battalion will form its Firing Line, other companies being sent out by the battalion to complete the formation. The Brigade, in both cases supposed, would extend to 3 paces, and would advance by its centre, the left file of the right battalion; this file will not fire, but move steadily on the Objective Point, supervised by the sergeant-major of that battalion and the Brigade-Major.

The battalion in the Firing Line not directing will march by the Brigade file of direction, its sergeant-major supervising its file of

direction, under the occasional supervision of the Major commanding its firing line and support; it will be noticed that the order of the companies in the left half-battalion is reversed, so as to get them in regular rotation in the Firing Line.

The directing battalion will send two signallers to the Brigade point of direction, and by their means, and signallers between, the Brigade-Major will keep communication with the General of the Brigade. A signaller will go with each Captain and keep communication with the reserve; the bugler will distribute ammunition. Signallers must be able to signal lying down.

In the case of a sudden attack by cavalry the Firing Line and the half companies in Support on each flank, will close on their centres, and throwing back their flanks slightly, receive the cavalry in line. If there is time, however, the companies in the Firing Line belonging to No. 1 battalion will close on their right flank, and those of No. 2 battalion on their left flank. The two companies, one on each flank in Support, one of whose special duties is to watch for cavalry will fire volleys into the flanks of the cavalry should they attempt to take the firing line in flank; should these companies be themselves attacked, they will receive the cavalry in line or square as the Captain thinks best. Any machine-guns with the battalion would probably be pushed well to the flank, also ready to enfilade cavalry. The reserve will advance, and as they have a clear field of fire between the Firing Line and themselves, they can fire at the cavalry if they approach.

The brigade will advance thus by its centre, the Firing Line moving like ordinary skirmishers till about the middle of the second zone, when it will probably come under artillery fire. The advance will now be by ranks without firing. This will be continued till the Firing Line becomes exposed to aimed infantry fire, probably about 800 yards from the position, unless the enemy have thrown out troops in front of their position to hinder the advance of the artillery of the Attack, when it will be earlier. When the Major in command of the directing firing line thinks it necessary, he will give the order to "Advance by ranks Firing." The directing company will fire first, and when its own flank company gets in line with it the directing company will advance again, and so on. As casualties occur and men drop out, the files keep on closing in towards the file of direction, till they get the ordered interval of two paces, the supernumerary rank keeping the men in file towards the directing file, but men of different companies will not be mixed, the interval of six paces between companies being maintained, no matter how few men are left in the company. The supports will reinforce the outer flank of the firing line by files as room is made, these men moving straight to their front and touching in towards the file of direction. The Reserve, under the Colonels, would advance in such a way as to be always able to reinforce the outer flanks of the Firing Line, sending its outer company to replace the company in Support, as it advances to replace the half-company absorbed into the Firing Line. The Colonels would adopt any for-

mation they chose, so as to lose as few men as possible. They would receive reports by signal as to the nature of the ground from their Majors with the Firing Line.

As all the direction comes from the Brigade point of direction in the centre of the Firing Line, the advance, by means of the signallers, should be under the complete control of the General of the Brigade. He may wish to signal orders here, as about this time his artillery will probably have been able to advance within 2,000 yards of the enemy's position, and might assist in the attack. Should the General signal orders, they would easily be carried out, as the men would be well in hand of their Captains and Colonels.

The advance will be steadily kept up till the Firing Line gets within about 450 yards of the Position (see Diagram 2, Plate 3), when the artillery of the attack will probably have advanced again, and got to within 1,200 yards of the position, and the General of the Brigade may wish to give orders, for if the enemy's position is not now well shaken, it would be advisable to crush it by a further artillery fire before the infantry advance nearer. That such is the proper course was shown at the battle of St. Privat, where the Prussian *main loss* was at some 500 yards from St. Privat; and, again, the Prussian attack on the village of Le Bourget, on the 30th October, 1870, gives the same lesson. Should the artillery have to fire over the heads of the infantry, which they might have to do in the attack of an Army Corps, as such a mass of artillery covers a very large front, the infantry will lie down. Unless contrary orders are received, the infantry will advance, firing steadily, being reinforced if necessary.

In the attack by a Division or Army Corps, should the Firing Line in its advance, between 500 yards and 50 yards, meet with such resistance as to require reinforcements, the Colonel requiring it will report by signal to the Brigadier, who will order the third battalion, or part of it, to go up from the Second Line. The third battalion will be replaced by the fourth battalion from the Third Line. Provision for such a change of duties would have been previously made by the strength of the attack being originally stronger against those points where it is likely such resistance would be met. Resuming our Brigade attack when the Firing Line has got to within about 50 yards of the enemy's position (see Diagram 3), the Colonel of the directing battalion will halt his directing company, and form line and rank entire; the left battalion conforming. Both Colonels will now give the order for "Independent firing with fixed sights." All this time the Second and Third lines have been steadily advancing, as shown in Diagram 2, their Colonels taking every advantage of the ground; and about the time the Firing Line gets to within 50 yards of the Position, the Second Line ought to be within 100 yards of the Firing Line, and whilst the Firing Line is independent firing, the Second Line will form line and rank entire, lying down about 10 yards in rear of the Firing Line, fixing bayonets as they are lying down ready to charge, *vide* Diagram 3. Should the resistance of the enemy have been so weak as not to cause the whole of the Reserves to be absorbed into the Firing Line, the companies of the Reserves overlapping the Second Line will

closely follow the flanks of the Second Line in its charge. I think it is one of the advantages of an attack on these lines that it permits this to be done, and thus allows a drill in the Attack Formation to be carried out in peace-time, without necessitating the large number of casualties falling out, as in the Field Exercise attack.

Practising losses in moderation may be good, but I doubt the wisdom of the present plan of simulating such large losses, for what must pass in the mind of a young soldier as he lies on the ground, himself a casualty, and two or three hundred like cases round him? The scene must make an impression on his young mind, which could not be so favourable as that of hunting on the mind of Mr. Jorrocks, when he gave utterance to the celebrated remark that "Hunting was the image of war with only 5 per cent. of its danger." Young soldiers cannot be inspired with confidence by such a scene, and it must be much more calculated to make them what a sportsman would term a bit "gunshy."

The remainder of the attack would be conducted as laid down in the Field Exercise, except that, in re-forming, the companies will each consist of their own men, and be in the regular rotation.

The attack formation for a battalion is the same as that shown in this Brigade attack, the battalion acting either as a right or left battalion.

The Company.

A form for attack for a company could easily be given on the same principles as those of a Brigade or a battalion, but a company is too small a unit to attack by itself. Its practice for the attack formation should consist of being thoroughly trained in its principal requirements, viz., in skirmishing, the advance by ranks, reinforcing, and the advance by ranks firing.

The Army Corps or Division.

In the attack by an army corps or division there will probably be two or more objective points, against each of which a division or brigade would be detailed.

Should, however, the army corps or division have only one objective point, and the attack be a long, continuous one, it will be conducted in exactly the same way as that given for a brigade acting by itself.

There will be one Directing Point, army corps, or division, as the case may be. The battalions on the right of this Directing Point will form for attack as the right battalion of a brigade; the battalions on the left of it as the left battalion of a brigade. In such a case, the supports of all battalions, except those of the two extreme flank battalions, will follow behind the battalion interval next their outer flank companies.

The strength of the troops opposite points where resistance is likely to be met will be increased by taking troops away from those points where there will be little resistance.

Colonel SLADE: I propose, Sir, with your permission and that of the meeting, to say a very few words on the interesting lecture that we have heard, and that in no hostile spirit. In the opening sentence of the lecture, Colonel Prior stated that the present attack formation was "virtually dead." In that case it seems to me that it is rather like flogging a dead horse to go on attacking a formation which is virtually dead. Without going into details, the main point of his lecture was that he proposes a new attack formation. Now it seems to me very doubtful whether he is on the right tack in proposing a new attack formation. It may be that the present attack formation is virtually dead; whether it should be replaced by another is a very different point. The Germans, who are after all very practical soldiers and have the experience of a great European war to guide them, have not only refused in their latest drill regulations to lay down any normal order of attack, but have positively forbidden it. They say that in war circumstances are always varying, and that the letter kills the spirit, and that the responsibility thrown upon Officers only brings out their better qualities, and therefore they utterly refuse to lay down any normal order of attack. I should say it is very possible when our new Drill Book comes out you will find that "attack formation" has gone by the board and will not be replaced, but we shall act in the same spirit, and as the Germans say, we will not have any normal order of attack; we will trust the Officers to carry out the attack according to the nature of the ground, and the position of the enemy in the best way they can, and according as they have been trained in peace-time; and that I believe to be the true spirit of the attack. After all, in our own present Regulations, though there is a normal order of attack it is distinctly laid down that that is not to be the guide under all circumstances, but it is merely given as an example of how, perhaps, best to carry out an attack under certain conditions. With regard to details, I should very much doubt whether at 50 yards from the enemy's position any battalion could then be trusted to go through any sort of manœuvre like forming into single rank and forming into line. I fancy when you come to within that distance, or anything approaching it, a halt would be fatal; the sole object will be to push on. Some Continental Powers in their latest regulations have introduced an "attack fire," *i.e.*, firing on the move. When they get within 300 yards the rifle is held at the hip and they go on and on firing, knowing perfectly well that at these short distances aiming and halting are all gone by the board; the only thing you can do is to push on and on, and I believe that will be the spirit of our new Regulations when they come out.

Captain H. L. PILKINGTON (21st Hussars): I should like to be allowed to say a word on the second factor which the lecturer lays down as necessary in considering an infantry attack formation. That factor is "the employment of cavalry in masses." I would rather substitute for that expression a wider one—"the employment of cavalry to check attacking infantry. The lecturer has admitted that the attack of cavalry on attacking infantry is a matter which must be considered; but, where he first deals with it, he appears to treat the matter rather lightly. "The subject," he says, "is a deeply engrossing cavalry one, but in considering any attack formation we cannot enter further into it than to take it into our calculations as a possibility, and as such to make our plans beforehand against it. I venture to think the experience of recent wars and the increase of cavalry which is now being made in most Continental armies justify the belief that the use of cavalry to check attacking infantry will be of pretty frequent occurrence in the wars of the future. And I fail to see why that attack should be limited to cavalry "in masses." If it is possible for large bodies of cavalry to break through the infantry fighting line, I think it will be also possible for small bodies, at any rate under favourable conditions, to break through; for the real resistance to a body of cavalry attacking an infantry line is the amount of fire which can be brought to bear upon it, and that is practically regulated by the number of rifles in or close to its line of advance. And I would point out that the true *rôle* of cavalry, employed in the manner indicated, appears to begin after it has broken through the firing line, and is at liberty to play havoc with the vitals of the division or brigade it is attacking, the internal fractions of which would be paralysed, unable to fire, unable to use the most effective means they possess of resisting cavalry, on account of the danger of doing more damage to one another than to the enemy. It will therefore be, I think, in any

plan of attack necessary in future to provide against an onslaught of cavalry as a probability rather than as a possibility merely, and to regard it as of prime importance to prevent cavalry breaking through the firing line. Now, from a cavalry soldier's point of view, the old formation in groups of four infantry soldiers, into which the firing line is supposed to fall to resist cavalry, is certainly an easy one to attack—particularly easy if the object of the cavalry is considered to be getting through the firing line—passing through it rather than breaking through it, and getting to work upon the detached portions of the division or brigade which lie behind that line. It appears to me that the formation proposed by the lecturer would, from this point of view, be even more advantageous to attacking cavalry than the old one, for not only would the intervals between the company squares which he proposes to form be wider and admit larger bodies than the intervals between the old groups of four, but the formation of company squares would necessarily take a longer time than the formation of groups of four, and that time would be the few moments during which the cavalry is advancing under close fire, the few moments in fact in which the infantry might, if not entering into the new formation, make their fire tell with the greatest effect upon the attacking cavalry. Of course it is too much to expect of any infantry that they will receive cavalry in single rank with considerable intervals between the man and man; but I doubt if it is expecting more than is expected of cavalry ordered to attack them, and I believe any cavalry Officer leading a squadron or a line against infantry would consider the ordinary formation known as rank entire—each man remaining on his own ground and guarding a front of about two paces—a more difficult formation to attack other than either the old groups of four or the company squares now proposed by the lecturer. I would, therefore, submit that the proper formation for the firing line, when attacked by cavalry, is "rank entire," reinforced, if necessary, from the supports.

Lieut.-Colonel M. J. KING-HARMAN: I must congratulate the lecturer upon having dealt in a very able manner with a very difficult subject. I am glad to hear from him that the present attack formation is now considered as dead; Colonel Slade has also told us the same thing. Colonel Prior has already dealt with the bad points of the system, so that there is no need to refer to it any more. I think with reference to an attack formation there are other points to be considered besides those that have been put forward. There is the nature of the ground over which we have to attack, and the people we have occupying those positions. For instance, to make an attack upon a disciplined enemy entrenched on level or undulating ground is a very different thing to attacking a force of undisciplined but warlike Asiatics strongly posted amongst rugged and steep hills, and so on: therefore, in following out one fixed plan we should very likely come to grief; especially if for the purpose of attacking an enemy on a hill we adopted the attack suited for level ground. I am strongly of opinion that it is very much better to practise a great many different forms of attack and to let every Commanding Officer go his own way to work. I think that is the plan now to be allowed on the Continent. I think the plan proposed by Colonel Prior has considerable advantages. It keeps the whole battalion together; it keeps the command of companies and the command of regiments more together than the present system, and therefore there is a good deal to commend, although as soon as the attack is launched, even in that formation, it is rather loose, the same as in the present one. The lecturer spoke of the *probability* of our having to attack uncivilized troops, but it seems to me that is what we are *always* doing, and we must adapt our formations to meet the varying circumstances which are inseparable from such kinds of warfare. With regard to the advance in the attack formation, a great deal is said about the "company of direction." I think when you get within 450 yards of any place the "company of direction" will not be taken much notice of by anybody; it will just be a case of go as hard as ever you can. It does not then matter what formation you are in, whether you are going upon the present system, or upon this proposed system; as regards the pace of the company of direction, you go as hard as ever you can, and your fire will be as hard as you can fire, or not firing at all. If you are firing from the hip, the running fire the first speaker spoke of just now, it will be very much, I take it, what it used to be the case in the old days,

when we had smooth-bores firing from the hip; and I think if you attack in any formation you will find the same thing, that it would go by itself; certainly when once the attack is launched, the power of the Commanding Officer is gone. I should like to see certain formations of attack forbidden, rather than certain ones authorized: but those that are authorized should be suited to the characteristics of the troops employed, to the British troops and the native troops of the Indian Army working in the same line with English troops. You would find that you would get probably a system of advancing by ranks, or by groups, or by four-deep formations, or something of that sort, and they would lend themselves much more to the characteristics of our soldiers, and you would get a much better command by the Officers. Then, when an attack is ordered by a brigade or a division, as soon as the object of attack is pointed out, let every Commanding Officer put his regiment in whatever formation he pleases. There need be no fear of one regiment being behind another, the pace will be just as hot as ever they can all make it; and I think in the same way with inspections; that General Officers should point out positions to be attacked, and the Commanding Officer should take up any formation he pleases, and let him be reported on accordingly. If he adopts a good system and works his men accordingly, in a formation suitable to the ground, he should be well reported on; but you should not restrict him to one normal formation. I have seen men running about on the sands of the sea shore throwing themselves flat on their stomachs, and doing all sorts of things which could not possibly be done if they were opposed to an enemy, or if they were doing it on hilly ground, practising in peace what they could not do in war, which is foolish. If, as has been stated, it is very likely that the new Drill Book will do away with any normal formations to be used in the attack, I think it will be an exceedingly good thing. At the same time, I think Colonel Prior has done very good service in bringing forward his lecture to-day.[1]

Captain O'CALLAGHAN: I rise to ask a question which has been suggested to me by what I have seen on the black-board with reference to noiseless powder, and I find also mentioned in the lecture a powder which should give little noise. Now, I have not as yet seen a particle of evidence to show that we have, or that we are likely to have, any means of propelling bullets without explosion, and any explosion without noise. Another point I noticed was that the lecturer said that in certain cases the men should open out so as to give them room to use their bayonets. But did he not consider that, the more room you give the men, the more bayonets they have opposed to them; for, if a man has a great deal of room to use his bayonet, he will have to use it against a great number of men if they are in close formation? With regard to firing from the hip, I may mention that I tried that very carefully at a rifle range, and the result of my practice, and that of several other men, on that occasion was this: I was the only one that hit the target at all. I fired at a target at 200 yards, but it was only after taking about two or three minutes each time to estimate the elevation of the rifle that I could hit it, and then I was often very far wrong in elevation, so that I am led to believe that firing from the hip, except at a few yards' distance, would be almost innocuous.

Major EDWARD PALLISER: There are two points that Colonel Prior has mentioned which I thought rather important: one was that the ranks should not be close together on account of the penetrating power of the new rifle bullets with smokeless powder, and the other was that he pointed out the advantage of lying down on account of the low trajectory of the projectiles. The penetrating power of the new rifle I have tried, and it is from 11 to 12 1-inch deal boards placed 12 inches apart. The bullet invariably, I may say, goes through 11 such boards, and sometimes it penetrates 12, that is, with smokeless powder. Hence, if the ranks are close, it would lead to several men being struck. The next point is that of lying down to avoid the effect of low trajectory. I was very interested in

[1] I am entirely opposed to the system of allowing the rank and file to get into the way of falling out so as to represent casualties; that kind of instruction should be confined to Officers and section commanders only, and no one else should ever be allowed to do such a thing.

reading a short time ago an article in the "United Service Magazine" for 1841. It was the account of an eye-witness, an Officer of the 1st Royals, which regiment was in Picton's Division. When the French brought forward their reserve artillery (12-pounders), at a distance of 400 yards, to batter Picton's division before the great assault of D'Erlon's Corps, the French Artillery Officers found that at that range, with their long 12-pounders, the trajectory was so flat that the shot passed over the British troops who were lying down. They accordingly abandoned the shot fire, and took to grape. These projectiles descended on the Division, killing and wounding a great many men. The escape of our troops on this occasion from round shot proves, as Colonel Prior pointed out, the necessity for soldiers to take every opportunity to avoid flat trajectory of projectiles by lying down when they can.

Lieut.-Colonel E. GUNTER: As no other Officer seems inclined to rise, I should like to say a few words. I think all Officers who take an interest in the tactics of the day are more or less united in opposing the normal attack formation. It is a bugbear. I think there is a general feeling that there should be no form for attack laid down in detail, but that certain fixed general principles should be laid down for its conduct. As, however, Colonel Prior thinks a normal attack should be established, and proposes an improved one, we must consider whether it has any great advantages over the established one. I think his point is that his attack is more suited to the characteristics of the British troops. I have not had time to look into the matter beforehand, so as to be able to criticize it in detail, but there are one or two points I should like to touch on. I may have misunderstood Colonel Prior, because it takes some little time to thoroughly grasp all the complicated business of such an attack formation; but, with regard to the conduct of the infantry of the first line when attacked by cavalry; this is a matter of principle. In common with a great many infantry Officers, I object to the idea that when cavalry attack infantry the latter must of necessity form squares, whether large or small. I think well-trained, courageous infantry can always receive the attack of cavalry in line, as we are taught, even when not exactly shoulder to shoulder. In the Franco-German War (I think it was at Sedan) the Prussian troops received and repulsed the gallant attacks of the French cavalry, not in squares but in line, or as they were. Why should not British troops do the same? If, as been ably pointed out by a cavalry Officer, the infantry are to be fussed about and got into squares, while the cavalry are closing on them, the cavalry will have a much better chance than if the infantry simply remain steady and receive them in whatever formation they happen to be. Supposing, however, these squares to have been formed. Colonel Prior says the cavalry charging through the gaps thus formed in the firing line would receive the fire of its reserves firing through this gap. All I can say is, I should not like to be in the firing line then. It is one thing to be shot by your enemies, You expect that, but it is very uncomfortable being shot by your own men. The proposed formation seems simple and symmetrical, and it might be carried out on even ground, but I should think it would be difficult when the ground is broken. As Colonel King-Harman has pointed out, I do not think it possible to make any change of formation under close fire, and lying down, fixing bayonets, &c., within 50 yards of the enemy, would, I think, be impossible. Colonel Prior has laid stress upon the fact that in future there will be no smoke, and that, therefore, his proposed attack can be easily carried out. We must, however, bear in mind that the German and other nations are making experiments with a view of creating smoke, and I think we shall find that the attackers will have to create smoke somehow before they can hope to push on their advance. With regard to firing from the hip, which Colonel Slade has mentioned as being re-introduced by the French, I hope we shall not follow their example. I am aware that there have been instances where on emergency such a plan has been adopted. In the Mutiny (I think at Lucknow) a few men, about to charge, fired a volley from the hip, and this was so unexpected that it had a great moral effect on the enemy, and the charge was successful, but, I trust the practice will not become general, for, as has been pointed out, the effect is almost always nil. Whether we have a normal attack formation, or whether it is abandoned, I trust we shall always endeavour to keep our men as cool as possible, remembering after all that it is fire, not formation, that

wins the battle. Accurate and efficient fire is the main point, and men cannot deliver that accurate and efficient fire unless they keep cool. Every effort should, therefore, I think, be made to attain this, and we ought not to abandon all hope of doing so until the last possible moment, until what may be called "the Donnybrook moment," arrives.

Lieut.-General J. H. DUNNE: What has been said by Colonel Gunter and others brings me on my legs. For the last twenty-five years I have had the privilege of commanding battalions, brigades, and divisions in those various and innumerable systems of attack which are being continually invented by different Officers. I am not going to enter into any question as to whether the lecturer's attack is better or worse, but I do hold that there must and ought to be some light sketchy mobile attack laid down, and kept up still in our Drill Book, for, from my comparatively long experience of the many Commanding Officers I have met, it is all very well to say "leave" it to every Commanding Officer to use his own discretion; but I believe that discretion very often would result in confusion. Each Commanding Officer, or many Commanding Officers, would insist upon introducing some peculiar faddish mode of their own. The consequence would be that in a large number of troops there would be no unity of action, even in manœuvring in times of peace, and I very much doubt whether there would be in actual war unless there was a certain amount of principle laid down for making an attack, bringing up the reserves, and opening fire. I am not going for one moment to confine people to exact ways. In everything else except this point I entirely agree with Colonel Slade, with whom I have had the honour of serving in a great many attacks, but I venture still to maintain that some sketchy normal system should always continue to be laid down for those attacks. Colonel Gunter said he did not believe it was ever necessary for attacking infantry in line of skirmishing attack to form into either groups or squares to meet the attacks of cavalry, in many of our little wars, in Aldershot and the Curragh, and various places. All I can say is I have myself been in command on one occasion of a troop of the 3rd Dragoon Guards when three companies of infantry were put out of action at once by Sir Arthur Herbert, as Umpire. I had the troop of the 3rd Dragoon Guards hidden behind a lime-kiln, where nobody could see them, and they were launched so suddenly and at such a pace on the flank of the infantry that that infantry must have been entirely swept down the whole length of its line, if they had not got, at all events, into some sort of square. Only a few moments elapsed before the cavalry were upon them, and how in the world can infantry form line against cavalry attacking on the flank in that manner? It would be impossible; if the cavalry were quick they must smash them up. Only two years ago, on the Fox Hills, I was out with the 10th Hussars. It was a time attack; if my opponents did not get up to my position and were not able to drive me from that position by a certain time, I won the day. I had squadrons and troops, even of the 10th, hidden where there was undulating ground, on the flanks of the attack of infantry, and by so doing, I over and over again, and by my hussar leaders charging in a self-sacrificing spirit, forced the infantry to stop, and form either squares or groups, and then peppered them with horse artillery. By that means I continually delayed the attack, so that at last the General gave it in my favour.

Colonel PRIOR, in reply: I thank you all very much for your kindness in coming here to-day, when I do not know how many things are going on, and I am much obliged to you for your presence. Colonel Slade remarked on my having said that the formations were "virtually dead." Well, the difficulty of a lecturer is that he must have something to hang his hat on. He must have some foundation to go upon, and, as the Field Exercise formations are being altered, I say they are virtually dead, because I hear very often in the clubs the question asked, "What will happen as to the Field Exercise formation?" and the answer is that it will right itself in war. What does that mean? It will right itself at the expense of thousands of men. Colonel Slade said that, if I thought the formation dead, what was the use of my flogging a dead horse? Well, I think in a case of that sort, if a horse is dead, and you think him a bad one, the best thing you can do is to dissect him, and find out his bad points, and that is what I have humbly tried to do. I hear a great many abuses of the old exercise formations, and I have tried to test them like a

chemical analysis by tests laid down in the Field Exercise. My object has been to try and get any little good that we can out of a formation; even, if it be dead, to try and make use of it. Another Officer spoke as to forming line at 50 yards. It is about 50 yards; but of course you cannot lay it down as such, and, as has been said, it would be perfectly absurd to attempt to form line at 50 yards, if you had a well-formed enemy in that position ready to meet you. In such a case what would be the use of falling in line 50 yards? I very much depend upon the use of artillery in the attack, and I especially said that, at 450 yards from the enemy's formation, it is especially necessary for the General to notice if the enemy are sufficiently crushed in that position to allow his infantry to advance, and I think any General would be very foolish to attempt to get near a position of that sort, unless he had thoroughly well crushed them by fire. When that is done, and he has ordered his advance, I think the plan submitted here of getting closer is better than the one laid down in the Field Exercise, in which it says, "When the second line"—that is the assaulting line—"gets to 400 yards from the position"—I assume they go along at a pretty good pace—"the firing line will proceed and describe Section 22, No. 11." Section 22, No. 11, says, "On arriving at, say, 150 yards from the position, the Captain will give the caution for independent firing." Therefore, by the Drill Book, the independent firing commences at 150 yards from the position. "At the time the assaulting line commences firing independently, the second line will move forward at a steady double." At 150 yards those men are to double with fixed bayonets under fire, and at the end of that they are supposed to use their bayonets. I should think, in such a case, they would be very much blown. If you want men to assault a position you must get them much closer than 150 yards, if they are to be of any good to use their bayonets. Another Officer said the employment of cavalry would be much more frequent in future wars than had been the case formerly. If that is so, I think we have all the more reason for taking steps to guard against that danger, and I think, if you have men well under the command of their Captains, they have much more chance of resisting a cavalry attack. I have shown in the first diagram, representing an attack at a distance of 1,000 yards from the position, the front company as 100 yards long, 200 yards deep, and in three different lines—the firing line and two supports. In the formation submitted on Diagram 4 on the wall the line is 100 yards. Now, which company could assemble quickest to resist cavalry? Then firing from the hip has been mentioned. I have quoted Prince Kraft, a man who has seen more actual service than anyone else. I have read out to you his remarks on the difficulty of stopping infantry firing, even when it is a steady fire well under command. He says the men like to hear the rattle of their rifles, and that is perfectly true. Now, when it is so difficult to stop firing, as Prince Kraft says, when the company is well under control, how much more difficult will it be when you have men running along with their rifles firing at the double? You will never stop them at all. Noiseless powder has also been referred to; of course I do not know whether there is to be noiseless powder, but everybody seems to think so. There is to be a smokeless powder, and, probably, a noiseless one; they all think so, but, at all events, so far as the argument goes, it would be much more difficult for troops in the Field Exercise formation to attack where there was smoke than without, because in that formation each company advanced by its centre, and you really have sixteen lines of advance. If there is smoke, how can the non-commissioned officer behind the centre of each company direct the advance? How are they all to advance, going to the same point? They would be all over the place. The danger of ranks firing at one another is, I think, proved by Major Palliser, when he says that it has been found, by trial, that the new bullet will go through twelve deal boards, each an inch thick, and at some distance from each other. It is quite possible with men 100 yards apart from one another, for a bullet, if it does not hit a bone, to go through two or three men. This shows the danger of having troops behind one another. As to the argument of having no normal formation, I think that has been disposed of by General Dunne, and I need not go into it. I think he has so plainly shown the advantage of having some sort of formation, that nothing more is necessary. When you have large bodies of men together you must have fixed rules, and those rules must have fixed points. I say you must have some normal attack, not a fixed point; but let us have independent

attack on small points. One Officer remarked that, with troops in this formation, he should be very sorry to be in the firing line, while the reserves were shooting through the gaps. I am afraid I did not quite explain the circumstances of that case. I said it was only when the firing line collected on its flank. The idea was that, if the cavalry attacked this body on its right, and that body on its left, the whole front is 800 paces, and there is no gap, because each of the battalions covers 400 paces. The front of the two companies shown in the diagram would be 100 files, 100 paces on each flank. Therefore, you would have 600 paces of open space, through which the reserves would fire at the cavalry advancing, and with smokeless powder and a smokeless field, I do not see why the firing line could not concentrate on each flank, so that, as some of the speakers have said, the cavalry should be received in line. The whole essence of this attack is that they should be received in line. The infantry concentrate on their centres. I have nothing further to add, but I am very much obliged to you for your kind attention.

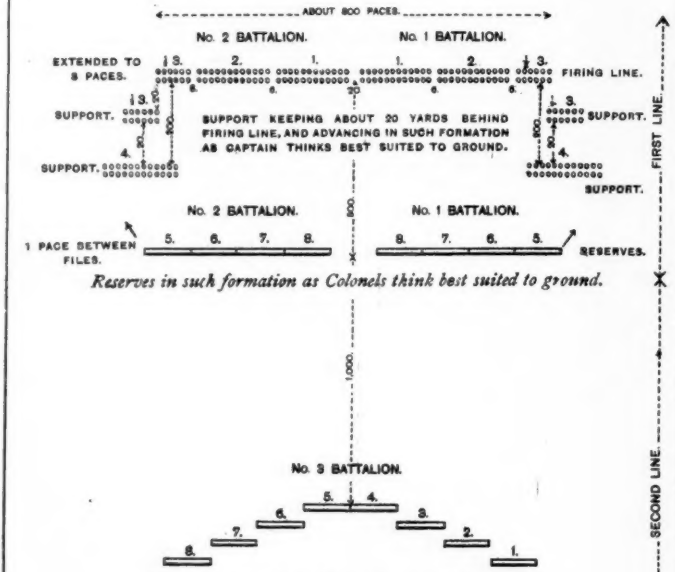
The CHAIRMAN: At this late hour of the evening, particularly as this is a matter very much out of my experience at present, I do not intend to detain the meeting. I think that the very fact of Colonel Prior's having taken exception to what is established, and having proposed something in the place of it, is deserving of praise, because I find the tendency of the present day is to take exception to everything and never to propose anything to replace it. Certainly I think great credit and praise is due to any Officer who will do as Colonel Prior has done, and I wish there were more who came forward here and laid down their views with something like precision. There are two points which I may advert to, and those are the great charges of the French cavalry that he spoke of, first at Wörth and afterwards at Sedan. Sedan I saw with my own eyes, Wörth I did not, because they all took place at a very considerable distance from where I was on the field, and the one of which I saw the after traces round the corner of a hill. On the next day I rode past the village of Morsbronn, a small hamlet near which it took place, and I suppose a wilder and more insane attack was never made in this world. There were two regiments of cuirassiers, and two squadrons of lancers. They attacked through vineyards, about the most difficult place that cavalry could pass through, and they attacked troops who were posted in houses and behind garden walls, in fact in as secure a position as infantry could well be in, and their fate was simple destruction; a more terrible sight I never witnessed than that which I rode through the next day. Though the men had been mostly removed, the dead horses, and arms and saddlery were all lying about, showing what the effect of the infantry fire had been. The attack at Sedan reminded me of an old story connected with the battle of Talavera. The attack at Sedan took place over most unfavourable ground. The men were most gallantly led, magnificently led; it took place twice: I am not sure if it was not three times. There was a dip almost amounting to a small ravine in the ground, into which the cavalry fell, and as they emerged on the other side of it they were shot down by the troops, the companies chiefly in support of the artillery. It was much the same at Talavera, where in a charge that took place one of our regiments came to very severe grief. Old Arentschild, who commanded a German regiment in support, on being told to charge over the ground said, "I vill not kill my young mans," and he entirely declined to charge. In that case there was also a ravine, into which the regiment, I do not remember which it was, fell on charging. I think we ought to be very much obliged to Colonel Prior, more especially as he has not a great deal of time on his hands. He leaves us to-morrow for a post in which I hope he will pass I do not know how many years, before he will rank out of it, but pass as happy years as I passed there fifty years ago. I think it is the best of quarters: certainly it used to be in my time—dear old Gibraltar—and I call upon you unanimously to wish him health and happiness in his new sphere of action.

DIAGRAM 1.

ATTACK OF A BRIGADE AT 1,000 YARDS FROM THE POSITION.

TWO BATTALIONS IN THE FIRST LINE, ONE IN THE SECOND, ONE IN THE THIRD.

N.B. THIS IS ALSO THE ATTACK FORMATION OF A BATTALION WHO WILL PRACTICE IT EITHER AS THE RIGHT BATTALION OF THE FIRING LINE, OR THE LEFT BATTALION.



Reserves in such formation as Colonels think best suited to ground.

No. 3 BATTALION.

In short echelon from the centre, or as Colonel directs.

N.B. 5 *Companies at* 3 *paces*		750
4 *Company intervals*		24
1 *Battalion*	,,	20
		794

No. 4 BATTALION.

In fours from right of companies or as Colonel directs.

ATTACK OF A BI

THE BRIGADE IS

TWO BATTALIONS IN THE F

NO. 1 DIRECTING COM

SOME OF T

NO. 2

FIRING LINE ADVANCING BY RANKS FIRING. No. 2

SUPPORT REINFORCING.

RESERVES INCLINING TOWARDS OUTER FLANKS IN SUCH FORMATION AS COLONEL DIRECTS.

ADVANCING BY RANKS IN SHORT ECHELON OR AS COLONEL DIRECTS.

ADVANCING ACCORDING CIRCUMSTANCES AND NATURE O THE BATTALION IS BEHIN RISING GROUND.

N.B. THE BRIGADIER HAVING SIGNALS TO THE COLO ONE OF HIS RESERVE RESERVES UNDER COVE

DIAGRAM 2.

CK OF A BRIGADE AT 450 YARDS FROM POSITION.

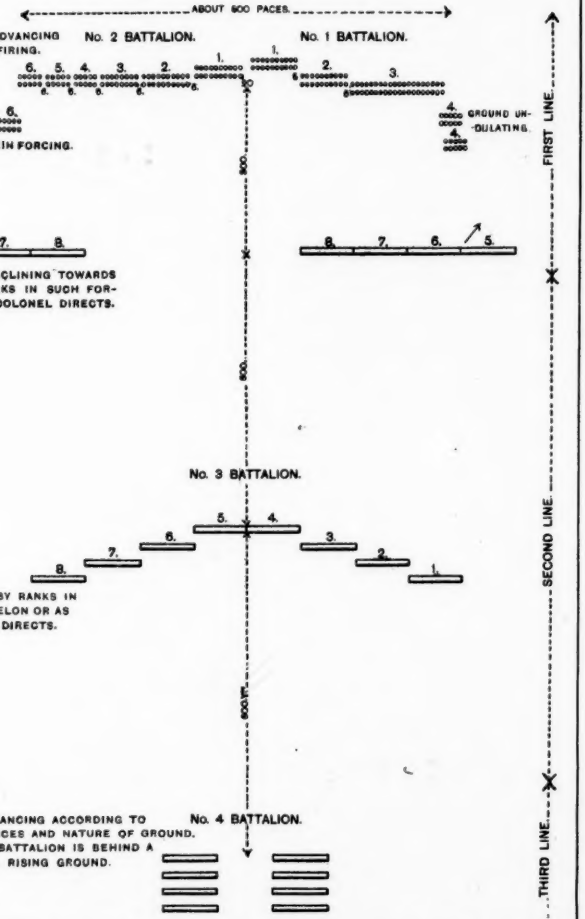
THE BRIGADE IS SUPPOSED TO BE SUPPORTED BY ARTILLERY.

LIONS IN THE FIRST LINE, ONE IN THE SECOND, AND ONE IN THE THIRD.

1 DIRECTING COMPANY OF THE BATTALION OF DIRECTION LEADING ADVANCE.

SOME OF THE SUPPORTS HAVE JOINED THE FIRING LINE.

NO. 2. BATTALION HAS SUFFERED HEAVY LOSSES.


ABOUT 600 PACES.
DVANCING FIRING.
No. 2 BATTALION.
No. 1 BATTALION.
GROUND UNDULATING.
IN FORCING.
CLINING TOWARDS KS IN SUCH FOR- OLONEL DIRECTS.
FIRST LINE.
SECOND LINE.
THIRD LINE.
No. 3 BATTALION.
BY RANKS IN ELON OR AS DIRECTS.
ANCING ACCORDING TO CES AND NATURE OF GROUND. BATTALION IS BEHIND A RISING GROUND.
No. 4 BATTALION.

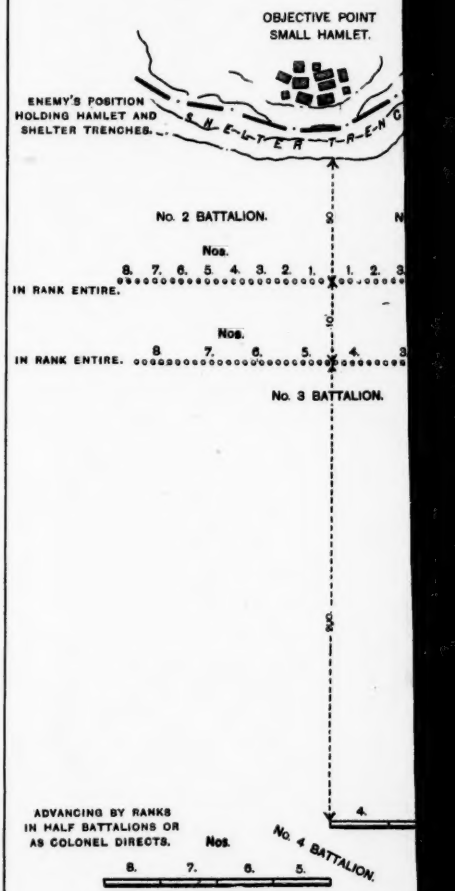
RIGADIER HAVING JUST OPENED FIRE WITH HIS ARTILLERY AT 1,200 YARDS RANGE, NALS TO THE COLONEL OF NO. 1 BATTALION TO REINFORCE NO. 2 BATTALION WITH OF HIS RESERVE COMPANIES, NOTICING SOME UNDULATING GROUND BETWEEN THE ERVES UNDER COVER OF WHICH THE COMPANY CAN GO.

DIAGRAM 3.

ATTACK OF A BRIGADE AT 50 YARD

THE WHOLE OF THE RESERVES IN THE FIRST LINE H TWO BATTALIONS ARE "INDEPENDENT FIRING" WITH FIXED

THE SECOND LINE, WHICH HAS BEEN ADVANCING BY R AND RANK ENTIRE, LYING DOWN ABOUT 10 YARDS IN REAR WHILE LYING DOWN PREVIOUS TO CHARGING.



N.B. Should the resistance be so weak as not to absorb th companies overlapping the Second Line will closely in its charge.

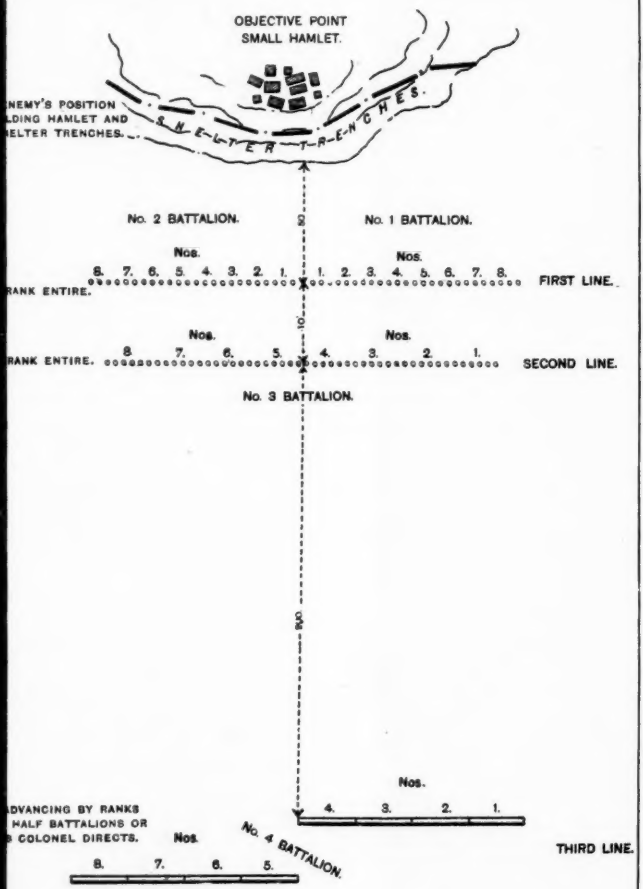
HARRISON & SONS. LITH. ST. MARTINS LANE, W.C.

DIAGRAM 3.

ATTACK OF A BRIGADE AT 50 YARDS FROM THE POSITION.

THE WHOLE OF THE RESERVES IN THE FIRST LINE HAVE JOINED THE FIRING LINE, AND ITS 20 BATTALIONS ARE "INDEPENDENT FIRING" WITH FIXED SIGHTS.

THE SECOND LINE, WHICH HAS BEEN ADVANCING BY RANKS IN DOUBLE ECHELON FORMS LINE 2 RANK ENTIRE, LYING DOWN ABOUT 10 YARDS IN REAR OF THE FIRST LINE, FIXING BAYONETS WHILE LYING DOWN PREVIOUS TO CHARGING.



B. Should the resistance be so weak as not to absorb the Reserves in the Firing Line, the companies overlapping the Second Line will closely follow the flanks of the Second Line in its charge.

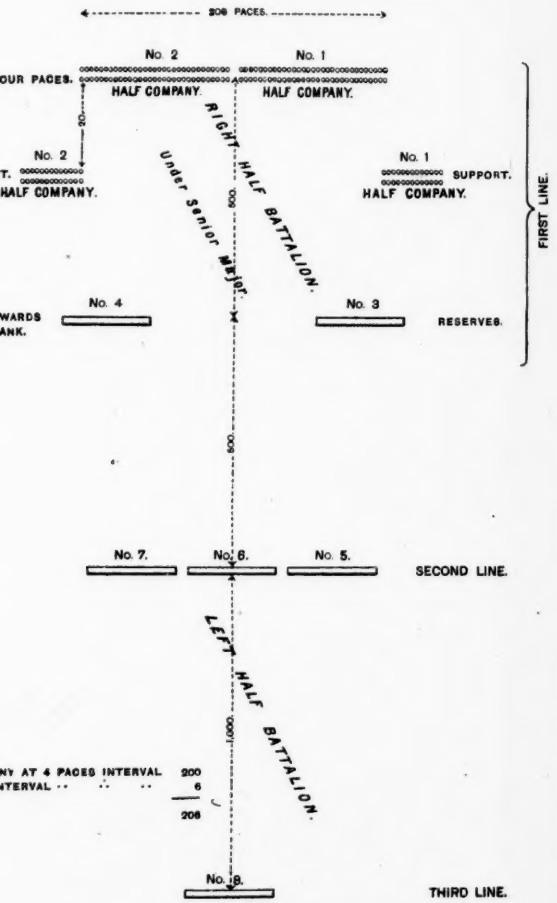
DIAGRAM 4.

A BATTALION

AS THE ATTACKING FORCE.

1ST ZONE.

THE BATTALION IS SUPPOSED TO BE ACTING BY ITSELF.



RESISTANCE BE SO WEAK AS NOT TO ABSORB THE RESERVES IN THE FIRING LINE, RLAPPING PORTIONS WILL FOLLOW THE FLANKS OF THE SECOND LINE IN ITS CHARGE.

TTALIONS SHOULD PRACTICE THE ATTACK AS THE RIGHT OR LEFT BATTALIONS OF A SO THAT THE OBJECTIVE POINT MAY BE OPPOSITE THEIR FLANK, AS IT WOULD BE ADE, DIVISION, OR ARMY CORPS ATTACK.

Friday, February 20, 1891.

ADMIRAL SIR EDWARD G. FANSHAWE, G.C.B.,
Vice-President, in the Chair.

MANNING THE FLEET; A RE-ARRANGEMENT OF EXISTING CORPS AND THEIR TRAINING.

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IN placing this paper before the Institution, it is necessary to explain that it was prepared in ignorance of the fact that the Admiralty had summoned a committee to consider matters with which the subject of the present reflections is closely allied. In these circumstances I should hesitate to offer the suggestions herein set forth, were it not that I am assured it will be well understood that this is merely an effort to assist in the elucidation of matters which are exercising, if not agitating, the minds of all thinkers on the subject of naval warfare as it interests our country.

The rapid disappearance of masts and sails from ships of war makes it evident that the duties of the personnel of the Fleet are undergoing a corresponding and great change.

Some naval officers are still persuaded that masts and sails ought to be retained for certain classes of vessels, and at least in view of the occasional expeditions required to be performed by H.M.'s ships this opinion seems correct; but whether or no this be so, the crews required for such vessels will not be more than the smaller portion of the seaman class of the Navy. The high standard of efficiency attained by our men-of-war's men in all exercises with arms where activity of body and celerity of movement are required, will freely be admitted by all who have experience in naval and military manœuvres. To what is this efficiency due? If seamen are as a rule more quick and active than any body of men not used to the sea, the reason would seem to lie in the training they have gone through, or the life they lead. The life of a British man-of-war's man apart from the exercise of the active work of his profession, has no special features which could set it above that of other bodies of men; but the ordinary round of a seaman's work is a constant exercise of the most important of his senses, a constant quickening of the powers both of body and of mind. The work of the masts and sails and the handling of the ship under sail are the principal matters which train

up and bring out the qualities of a man. The seaman whilst aloft, continually holds his life in his hand; like animals of the chase, his wits are sharpened by the knowledge that life depends on his activity and quickness of eye; till use becomes second nature, and celerity of movement a natural function. The officer if in his youth he is trained aloft, acquires a large portion of the same activity of movement; but the important duties of responsible stations in a ship under sail, are as great an exercise to his combined mental and physical powers, as the more simple bodily exercise is in a lower degree, to the powers of the seaman. Can any training equally powerful in developing combined mental and physical energy be found? If such is possible, no advance has yet been made towards discovering it. Gymnastics increase bodily activity, certain studies develop that of the mind, but these exercises united will not produce the desired combination. No doubt there are certain occupations which keep a strain on mind and body alike, and to this extent probably foster in an almost similar degree the activity produced by the work of a sailing ship; such are the lives of hunters, ranchmen, and cowboys; but in no case are men of these classes to be obtained in large numbers for sea service, nor does their training in any way fit them specially for a life at sea. It is said that in the year 1793, on the outbreak of war with France, Sir Edward Pellew, being forced to complete the "Nymphe's" ship's company with landsmen, selected Cornish miners, as men whose dangerous life would the most readily cause them to accommodate themselves to the dangers of that of a seaman; but, if this really was so, few would be found to advocate now such a training as a substitute for that in a ship at sea. If the British man-of-war's man is, in times immediately approaching, to be equal in gun drill, in rifle drill, as a field artilleryman, or as an irregular soldier, to what he has been in times past and is now, he must have a special training; and an indispensable part of this training can practically be got nowhere but with masts and sails. How this can be made possible will be dealt with later on; but enough has been now said to indicate that of the proposals about to be set forth, the retention of a proportion of seamen of the same bringing up as in the near past is an important feature. It would be better if this proportion could be the same as at present; but not being possible, the next best thing must be accepted, viz., a part of the crew to whom the best sort of preliminary training has been given, and the remainder trained as well as circumstances admit.

The fundamental assumption of this paper is that Her Majesty's ships of war will, in time of war almost exclusively, and for by far the greater part at all other times, be propelled by steam power alone; and therefore have no sails. Such vessels evidently do not, for the work of the ship, necessarily require men able to handle sails; the value of such men resides in the habits of mind and body induced by training aloft, followed up by suitable exercise in the special duties they now have to perform. But however useful such highly trained men may be, they need not form the majority of the crew; in fact the seamen of the old sort may well in

our new ships, be borne in comparatively small numbers. It is on this ground, on the fact that a complete revolution in the duties of the crew of a man-of-war has taken place, that a proposal for a re-arrangement of the personnel of the Navy can be based. The duties devolving on the officers of the different classes and branches are likely, in the near future, to undergo some change; it is not, however, intended here to deal generally with that division of the subject, but merely to touch on such parts of it as present themselves in connection with a re-arrangement of the different bodies from which the crews of our ships are drawn.

These bodies are—

(*a.*) The class of the seaman proper, or, as called sometimes in Parliament, the pure bluejacket. This body is at present recruited from boys exclusively: each individual spends about a year in a stationary training ship; where he is instructed in every branch of the duties of his class; including work aloft and in boats, gunnery, &c. At the end of his term of training he is available for sea service. As soon as he is required in a seagoing ship he is drafted to one with or without masts, and in the latter case his knowledge of work aloft may easily end there. If, however, his fortune should carry him to the Training Squadron, or to a masted ship on stations where sails are used, he may acquire all the advantages of thorough practice aloft. It will thus be seen that, at the present day, the work of our men, after leaving the boys' training ship, does not run in one direction alone: a portion become seamen somewhat of the old type, another portion are employed in work of a different nature, and a third portion spend their time of service in a combination of the two kinds of duty. The signal class are derived from this body.

(*b.*) The steam party, which now forms such a large part of the crew, is divided into—

(1.) Engine-room artificers.
(2.) Stoker petty officers and stokers.

Both classes are entered direct from the shore; the first as men having some trade qualifications for their duties afloat; the second having none but those of physical ability, and often this in but a moderate degree. The stokers are taught their special duties practically, and are further drilled in the use of small-arms, &c.

(*c.*) The artificers for the repairs of the ships and their furniture are for the most part, entered as qualified workmen; but a certain number join as boys, and are passed through the training ships. The whole of this body are drilled in the use of small-arms, &c., and, where necessary, receive special instruction for their duties.

(*d.*) The remainder of the ship's company is composed of domestics, sick bay staff, &c., entered in various ways, which it is not necessary to dwell upon; and who receive the instruction requisite for performing their duties in action, in case of fire, &c.

(*e.*) The Royal Marine Forces, comprising Artillery and Light Infantry, are entered and trained on shore as soldiers, and are drafted afloat as required; but beyond their military training, they receive

special instruction for service afloat; so that, in naval gunnery, an Artilleryman may be said to be on a par with a seaman gunner, and a Light Infantryman with the seaman's qualification of trained man.

The sources then from which the crew of a man-of-war is drawn, and the modes of preparation of the different bodies, are seen to be various. There are advantages and disadvantages in this system, the principal of the former being perhaps some small economy, the principal of the latter increased labour in manning the fleet, in organizing, and in teaching discipline. The net gain, when economy is balanced against efficiency, is very doubtful. When a certain standard of work is to be kept up, no saving is effected beyond a certain point by reducing either the quantity or the quality of the labour; for example, a good workman at 6*s*. a day will often be of more value than two indifferent ones at 4*s*. each. This is a general proposition; but a special exemplification of it is the present body of 2nd class stokers.

The method of manning our ships, such as it is, is historical; no one could explain the different parts of our naval system without remembering its history; the composition of the crews of our men-of-war was formerly indeed heterogeneous, and this condition altered but slowly whilst the general form and possible mode of propulsion of the ships remained the same. Now, however, with an entirely different fighting machine for use on the seas, the requirements in the men have changed; and the feeling that a different system with regard to the personnel is advisable, naturally presses itself on our notice.

As a rule, in great undertakings an invariable standard of efficiency in the whole of the operators is by no means required; there must be skilled superiors, skilled workmen, and unskilled labourers. The Navy is no exception to this, and it must educate its people for their duties; but as it is unnecessary to bring all up to the same point of education, so it is unnecessary to put all through the same preliminary course. This, however, is attempted, or nominally so, in the case of the seamen, all of whom pass through the boy's training ships, and are supposed to come up to the same standard of seamanship; that they should do so is, under the present system, impossible, and the conditions which formerly required it have now passed away.

At various times, of late years, much has been written and said on the question of what in the next war will be the principal offensive weapon for ships, whether the gun, the ram, or the torpedo; and different views have been advanced by different authorities; but it is certain that it is the gun which most impresses men's minds, and the development of which receives the greatest amount of attention. Naval gunnery, therefore, must hold the first place in the acquirements of the crews of our ships, and the attainment of superiority in this is the principal object to be kept in view in the training of our men-of-war's men.

Our requirements now are—putting on one side the engine-room duties—the highest attainable mental and bodily activity for the

leading employments in gunnery and torpedo work, and in a few other special positions; the 2nd class of efficiency in men for the ordinary gunnery occupations, and for the more important part of the duties of the ship and in boats; and the 3rd class of efficiency or training, or what may be called the general average, for all the remainder of the work.

The men at present provided for the foregoing duties are, the class of the seaman proper and the Marines. With very few exceptions, the most important duties are assigned to the seaman class; this, in the view already set forth that the seaman from his exercise aloft has an incomparable advantage over the Marine, seems perfectly right; but, as before remarked, in the conditions to which the naval service has now advanced, there is no practical possibility of giving the superior preliminary training to so large a body as the present one of the seaman class, and no necessity for so doing, if it were possible.

The relative value as gunners of the different components of the working part of the crew is much as follows:—

Seamen gunners.
Marine Artillery.
The remainder of the seamen.
Marine Light Infantry.

So that if the portion of men trained as seamen gunners be sufficient for the special seaman's duties in working the vessel, it would appear that the ship with Marine Artillerymen substituted for the remainder of the seamen would be a better man-of-war than if manned on the present system. And undoubtedly this is so; but the arrangement would be unnecessarily costly, as it is not required that every working man should be trained to such a high point.

The Marine Artillery are a highly drilled and most efficient body, but they are not needed afloat whilst there are sufficient seamen gunners. Except for the key of history, the existence of the corps would be a naval puzzle. Without access to official records, it is always dangerous to pronounce an opinion on a question of public policy; but so long as this body has no more important part to perform amongst our fighting forces than that now allotted to it, there seems to be next to nothing to be said in favour of its continuance. There is a duty which seems naturally pointed out for a highly trained military corps accustomed to sea life and under the Admiralty; but the execution of this has been assigned to the Army, and the question therefore forms no part of the subject of this paper.

It being then impossible to employ the Marine Artillery afloat according to their just value, it will, for the moment, be more convenient to consider them together with the Infantry.

Of the three gunnery components of a ship's crew, viz.:—

Seamen gunners,
Seamen,
Marines,

there is, so far as fighting attainments go, one which forms a superior order, the seamen gunners; and two which may be grouped together, viz., the rest of the seamen and the Marines.

Every effort must be made that this superior order shall have the best of training.

It is to be observed, first, that all our seamen cannot be trained in masted ships; second, that whilst (as under the present system) they all start on an equal footing, and on equal terms of service, the selection of men for seamen gunners cannot be restricted to such men as have been trained in masted ships.

In these circumstances, it would seem advisable to make some change whereby the need for such a restricted selection may be avoided, and yet all the men required for seamen gunners may have had adequate practice in vessels with sails.

It is now held by many authorities that the limitation of the distinction and special training of seamen gunners to a portion only of the whole body of seamen should be abolished, and that all men should be seamen gunners.

Firstly, is this reasonably practicable? Secondly, if so, is it advisable?

To carry out such a change, either the period under instruction must be shorter than at present, or the number of seamen in the Navy must be increased to allow for the greater number under instruction.

A shorter period of instruction would imply a lowering of the standard, and this seems decidedly objectionable; whilst an increase in the number of men, though highly desirable from the point of view of manning the fleet in war-time, would reduce the proportion of men trained aloft, and the sea service of every man.

It does not therefore seem reasonably practicable, and certainly does not seem advisable.

As time spent actually out of harbour is an indispensable element in the bringing up of a man-of-war's man, so up to a certain, and that a very advanced, point, his efficiency continues to be improved by it.

A deficiency of sea service is a loss in the case of any seafaring man; where the general average of the crew, or men of the 3rd class of efficiency, is concerned, a certain reduction of time now spent actually at sea would not be of excessive importance, but in the case of the men for the higher training, *i.e.*, of the 1st and 2nd orders of efficiency (or seamen gunners) the loss would be very serious. It may here be observed in passing, that if the proper amount of practice at sea cannot be given to men of the higher orders of efficiency without reducing the sea service of the men of the 3rd order, this sacrifice should unhesitatingly be made.

It must, therefore, be pronounced that the acceptance for the more highly-trained men of reduced experience at sea is impossible. The whole body of seamen at present cannot be given adequate practice at sea; consequently, whilst maintaining the existing standard for the gunnery course, the entire present body of seamen cannot be put

on one and the same level of instruction, to the extent of passing them all through the gunnery schools now in use.

The matter then reduces itself to this: that two elements in unequal numbers are needed to form the working crew of a ship, the larger but inferior portion well trained in gunnery and practised by such service at sea as can be afforded them; the smaller but superior portion, prepared by a training in seamanship of the old kind, and with much more extended service at sea than could be given to the majority, this followed by what now answers to the seaman gunner's training. From this smaller body would be selected, as at present, the men for the most important gunnery and torpedo qualifications. This will fulfil the requirements before stated, viz., the highest mental and bodily activity for the principal employments, the 2nd class of efficiency for the ordinary gunnery occupations, &c., and more important part of the work of the ship, &c., and the 3rd class of efficiency and training for the rest of the work.

Before proceeding further it will be well to re-state in explicit terms the main propositions here set forth.

They are:—

1st. That, putting on one side questions relating to steam power, efficiency in gunnery is, as regards the personnel, the matter of the first importance in naval warfare.

2nd. That an important part of the high efficiency of naval gunnery is due to the practice of the seamen in masted ships.

3rd. That, without departing from the present policy of mastless fighting ships, it is possible, and therefore essentially necessary, to give all seamen gunners a preliminary training in ships with sails.

To accomplish the end in view—putting the matter in a few words—it is now proposed that the relative proportion of Marines and so-called seamen in the complements of ships should be altered, the seamen being reduced, the Marines increased.

It has been stated that a step in this direction was in contemplation, perhaps it has been already ordered; but, to meet the object proposed by this paper, the change of proportions must be greater than anything yet publicly hinted at. At the present time the Marines, in the complement of a ship, form about one-sixth or one-seventh of the whole; with the exception of work aloft, their duty is in principle precisely the same as that of the seamen, though practice has assigned, in the absence of good reason to the contrary, special functions to either class. Where there are no masts and sails, the duties of the Marines may, without any inconvenience, become identical with those of the seamen. Even with the present difference of experience at sea of seamen and Marines, this is, in small ships, frequently proved by the efficiency and value of the detachment in all matters.

The extended employment afloat of the Marines would be accompanied, not only by an identification of their duties with those of the seamen; but also by an assimilation, as far as possible, of regulations

as to service, &c., concerning them; the discipline would be one and the same.

This partial merging of the positions of seamen and Marines does not at all imply that Marines would be expected to take the foremost duties at the helm, in boats, &c.; but it is highly probable many of them would show their capability of doing so, when the learning of seamen's duties was no longer considered unsuited to Marine discipline. Amongst the seamen there are many who during all their service can be trusted to take no leading part, and even in their own profession remain below the level of a handy Marine.

The proposed modification of the duties of Marines afloat would by no means hinder the employment of land forces to serve as a part of the complement of ships as in former times, if such a necessity should arise. But independently of the question of suddenly, in time of need, augmenting our sea forces by the introduction of a body of men disciplined and trained to arms, there is now no reason at all for employing on board ship men brought up and instructed as land forces, and yet such is the result of the present system of the training and discipline of the Marines.

In the year 1699, in answer to arguments put forth against the employment of Marines afloat, it was urged in support of the practice that the Marines were much better in the use of small-arms than the seamen; and that, the periods of service of the latter being more irregular than that of the former, the discipline of the Marines was superior, and gave great advantages in case of misconduct occurring amongst the less orderly part of the crew. Such reasons exist no longer; the seamen have a complete knowledge of the use of arms, and the Marines are not looked to for the preservation of discipline.

The intention with regard to the Marines in the time of William the Third is, however, much more in consonance with our present needs; we are told that then the Marines were raised with the sole view of being a nursery to man our fleets, "as each individual became properly qualified to act on board of ship as a foremast man, which was uniformly encouraged, he was discharged from his regiment, and entered upon the books as such." This intention seems to have been abandoned when the regiments were re-formed under Queen Anne.

The original temporary nature of the Marine force will be noticed later on, but it is now time to consider the relative proportion of seamen and Marines in the crews of ships. This is now very different from what it was a hundred years ago: ships then depended on their sails, not only for locomotion, but also for manœuvring in action, so that efficient handling of the ship was scarcely second in importance to handling of the guns; and yet we find the general composition of the crews stated as one-third ordinary landsmen, "one-third Marines, and one-third seamen." It is not surprising that the remark follows:—"The latter proportion was as few seamen as could possibly navigate the ships," and no doubt it was so; but if in those circumstances one-third of seamen did actually suffice, what number is necessary now? Assuming that each of the landsmen mentioned

above was about equal to a Marine, the crews would be formed of one-third seamen and two-thirds Marines. It seems highly probable that this would be a very proper proportion for the present time.

But in carrying out the scheme of this paper, the relative proportions in our existing complements might be altered by degrees, tentatively—beginning with one-fourth of the ship's complement Marines instead of one-sixth. It may be remarked that this mode of effecting the alteration would have the great advantage of performing it gradually; no violent changes would be necessary; in fact, if not published, it might be in force for a considerable time without attracting notice. To carry out, however, the system in its entirety, a much more complete change will be necessary. If together with the alteration in the proportion of Marines afloat the present organization were maintained, keeping an impassable barrier between the two forces, the Marine headquarters must be considerably enlarged, the number of boys' training ships reduced.

But the time seems to have arrived when a new organization is desirable—an organization assimilating the discipline of the whole of the naval forces.

The establishment of naval barracks for the seamen has now become an acknowledged necessity; not only is the sojourn of the men in receiving ships distasteful to the men and injurious to discipline, but, owing to the altered construction of modern vessels, the conditions of life in the sea-going ships are entirely changed. In old ships the officers and seamen were frequently in close proximity to one another in their mess places, as well as whilst on duty, and in all cases they came much in contact; but now the reduction in the number of young officers, the alteration of their duties withdrawing them from constant attendance with, or supervision of, their men, the construction of the ships, which separates the men's dwelling-place into small sections, and hides them alike from their officers and from other portions of the crew—all have combined to render most difficult, in many cases, the disciplining of a crew on board their own ship, and to make the tone of the men dependent on the habits previously instilled into them. From the moment of a boy's entry into the service, joining a training ship, his training in discipline begins; and good habits early inculcated are lasting; but a continued high standard demands constant attention; and the more the men can be massed together when they cannot be employed at sea, the better it will be for naval efficiency.

It has been seen that the Marine Artillery occupy a very anomalous position; the connection of the corps with the Navy afloat would now (by the scheme) be entirely severed; or the force would be united with the Marine Light Infantry; and the united bodies (or the Infantry, as might be decided) would become a sea artillery corps, trained up in gunnery to a higher point than is at present reached by the Infantry, but to a lower point than is attained by the Artillery.

The crew of a man-of-war always containing seamen and Marines, it is a system worthy of the dark ages alone from which it has descended, that the power and control of the officers of each force

should not extend freely to their inferiors in the other corps, though it is true that the restriction is rather one-sided. It does not appear that this practice is in accordance with the spirit of the Queen's Regulations; but that powerful law, the Custom of the Navy, decidedly supports it. A reference again to history will throw some light on the matter.

In the year 1759, an Order in Council was issued establishing appointments as Generals of Marines, which appointments were to be held by Admirals. Alluding to an increase of the Marines, the Order says, "This great increase of the number, we apprehend, will make it necessary, in order to preserve discipline and regularity amongst so great a body of men, that we should have some officers of rank in the Navy to assist us therein, who may frequently review them, both afloat and ashore, &c." Sir John Barrow states that this was not the real intention, and that the appointments were only intended to be sinecures. We find, however, that the next year Post-Captains were appointed as Colonels of Marines; and in 1763—three years later—the Admiralty addressed an order to Lord Howe, as Colonel of Marines, directing him to call out under arms all the Marine forces at Chatham, and review them, &c. In any case it is clear that the feeling was that the qualifications of the corps—a corps recently formed for the Navy—were to be decided from a seaman's, not from a soldier's, point of view. Later in the century, the unhappy disturbances of discipline in the seamen of the Navy caused the adoption of the policy of, so to say, drawing off the Marines into a separate camp. Lord St. Vincent was very strong on this point, as his written orders show, and it is not surprising that the lessons taught by him should encourage in the corps a spirit of exclusiveness, and in the seamen and their officers a feeling that this exclusiveness must be respected. The reasons which gave rise to these distinctions have long passed away. The discipline of the seamen is almost equal to that of the Marines; and it will be quite so when the disorganizing influence of service in ships where the inculcation of discipline is most difficult is shared by both bodies alike; and when the seamen at intervals pass through a healthy re-toning in barracks on shore, as is now done by the Marines at the head-quarters.

In the new organization, the Marine officer whilst afloat would, according to his rank, be employed in the duties of the ship; his work being assigned according to his ability. There can be little doubt as to the healthy moral effect of this, and such a change would probably be welcomed by the officers. As far as their acquirements at present go, there is no reason why the officers of Marines should not be employed in general gunnery drills, in internal duties of the ship, and in other useful matters; and an extension of responsibility would very quickly produce an increase of attainments. By the regulations for the admission of gentlemen to the Marine force, a young man may now at the age of nineteen years, find himself a Lieutenant of Marines on board one of Her Majesty's ships; that is to say, one year before the age at which many Midshipmen pass for

Acting Sub-Lieutenant; he may have had uninterrupted work at school up to the age of sixteen (allowing for a subsequent period of injurious cramming), and he will have had nine months' excellent instruction at Greenwich. He will thus, in the opinion of many, have had great educational advantages over the young naval Officer. Without supposing that the entry of officers for the Marines is likely to be deliberately arranged as a second channel for the admission of naval officers (though in other branches of Her Majesty's service two channels exist), there seems no reason why it should not be suffered to become so; what an advantage would not such a system in full working order several years ago, be now affording in the existing difficulty as to the paucity of Lieutenants!

The great argument used for the youthful entry of naval Cadets is that, unless the boy comes early to sea he will not take to the life, and will become, therefore, lost to the Service, or else make an indifferent officer; but it is known that good sea officers have been produced amongst those who have taken to the life at eighteen years and upwards; and whilst, as a rule, entering boys younger, there seems no sufficient reason for barring admittance to those whose tastes have been more maturely formed. Boys develop at very different ages, and the most precocious tastes are not necessarily the most lasting.

Whether such a system be permitted or no, there seems nothing to prevent the young Marine officer, in the example mentioned, becoming in every way a most useful officer afloat, as well as on shore.

The advantage of giving every one on board ship adequate employment is unquestioned; space is limited, and those for whom sufficient work cannot be found, had better be left on shore.

The position of the Marine officer afloat, especially with regard to the men of the same corps, would be pretty much that of a Divisional Officer; in all other respects he would, in the position in which, according to his ability he is placed, command indifferently seamen and Marines.

To these proposals as to the Marine corps it may be objected that in view of the present high state of discipline and efficiency of the force, it is better to let well alone, and not to try experiments. Such an argument would oppose advance of any kind, and cannot be considered of more weight here than in any other branch of progress.

It may also possibly be urged, that to modify the military organization of the Marines would impair their efficiency as land troops, it being the custom to attach a battalion of them to the Army in all warlike expeditions. This will not be so at all; in fact much advantage might result from the co-operation of a military body enjoying a training and organization somewhat between that of infantry, of artillery, and of seamen. But in reality this last question is beside the mark; the Marines are raised as a part of the naval forces. It is all very well, when convenient, to employ them with the Army, but their real work is service at sea.

If the organization of the Marines is not to depend solely on their

connection with the sea service, and is not to be modified as often as the benefit of that service requires, the corps should be withdrawn to the position of the French "Infanterie de Marine," who do not ordinarily serve afloat, and a body with such organization as is here advocated should be established, thus leaving it possible to attain the prime object, viz., a sufficient training at sea of those who are called and required to do the work of seamen.

For the year 1889 to 1890 the numbers of officers and men voted were:—

For the Navy, 41,730, of whom 21,252 were "seaman-class men," and 8,725 of the steam party, not officers.

For the Marines, 13,864, of whom 7,099 were for service afloat.

For the present year, 1890 to 1891, the numbers of the Marines remain practically the same, whilst there is an increase of 1,645 for the Navy.

But the increase cannot stop here; our force of ships is most properly being augmented, and this will entail an enlarged supply of men. It may be remarked that, whilst other navies of Europe are also becoming larger, the available sources for seamen of the first class of the Royal Naval Reserve have already been drawn upon to their full extent.

The whole body of the seaman class of the Navy being now entered in and passed through the stationary training ships, and these ships being practically unable to accommodate more than the present numbers, an enlarged entry under the existing system would entail more training ships, or a shorter period of training. The latter alternative is inadmissible; and with an altered system the amount an additional ship would cost might be employed otherwise to greater advantage.

Acting on the present proposals, the proportion of seamen would be reduced; so that, even with some considerable increase of the total personnel for service afloat, beyond what is now voted, the present training ships would be more than enough for the number required.

Leaving this question for the time, and turning to that of the entry and training of the Marines, it will be seen that a considerable increase in their numbers would be necessitated, both by the extended employment of them afloat, and by the extinction of the Royal Marine Artillery, so far as sea service is concerned, or by their amalgamation with the Infantry. The addition to or alteration in the present mode of raising the men would be slight, but it should be accompanied by the entry of a certain proportion at an earlier age. By the proposed scheme this would be done in the training ships; the actual numbers of boys to be so raised must be settled after some experience; but, to begin with, the staffs of the present training ships would be maintained at their actual strength, and the ships kept up to their full number of boys, the portion not required for seamen being assigned to the Marines. The selection in the training ships of the boys for seamen and boys for Marines, and the modifications of the training for the latter after their selection, are matters of detail which need not be gone into here.

The extended instruction required to be given to the Marines to form sea artillery should present no difficulty; the general course to be as at present, except that it would include as much work as possible in boats, and that the standard of gunnery will be at least that of Trained Man. The qualification of Trained Man, as a rating carrying pay, would be abolished both for seamen and Marines; and all the fighting men trained to reach at least this point of efficiency. Advanced courses, leading each to a special qualification carrying a small pecuniary allowance, would be established, *e.g.*,

In field artillery drill.
In laboratory work.
In fitting gun gear.
In torpedo work.

The majority of the small trades, such as barber, butcher, &c., formerly exercised on board ship by specially entered men, have recently been taken by men of the Marines; probably all the trades still carrying distinct ratings could, with the exception of those for the repair of the ship or her furniture, be carried out by men of the Marines.

Dress or uniform is a factor in discipline, and a more powerful one than might appear to casual observation; as such and not otherwise it concerns the subject of this paper. The existing uniform of the Marines shows a connection with the Army; it gives no indication that the corps is raised, and exists, for the sea service. With a drawing together of the discipline of the two principal co-efficients of the Navy, some connection might be shown in the dress. In the year 1781, Admiral Keppel, speaking of Marines for service afloat, is reported as saying: "He never wished them to wear a red coat or any badge which distinguished them from sailors." It may appear strange that this feeling, probably a very general one, has never been acted upon; but the explanation seems simple. Up to the middle of the last century, the Marines, under the name of "The Mariners" or "The Marine Regiments" were a temporary force, raised for war only, and "broken" or disbanded on the conclusion of peace, and they had no permanent connection with the Navy. Although this system was altered at the outbreak of the Seven Years War, and the Marines were then finally placed on a permanent footing, it is probable that this distinction was lost sight of, and that they continued to be regarded as a body apart from the Navy.

The passing away of this view was no doubt arrested by the policy of Lord St. Vincent, and by the frequent employment of actual land forces to complete deficiencies in the crews of ships; and being thus firmly fixed, it has existed till the present day.

The tendency of alterations of uniform of the Army has in late years been in the direction of the greater ease and freedom of the seaman's dress; but, on the other hand, this ease is receding before the altered conditions of life on board ship. Boots now become a necessity for the seamen; and loose fitting clothes and

knife lanyards become tiresome, if not dangerous, whilst working with moving machinery.

Under the proposed scheme, the training of the seamen would be more extended than that of the Marines. Boys, to about the same number as at present, will be entered in the training ships, the number required as seamen being passed through as such, and the surplus transferred to the Marines. The mode of selecting the boys for these two branches of the Service is a matter of detail; good men afloat are not necessarily good men ashore, and *vice versâ*; and it would not at all stand to reason that most of the valuable men would find their way into one branch. A higher standard of school instruction on entry should be required; the improved education of the country at large warrants this. Less time at school in the training ship would then be necessary, unless it were decided to raise the passing out standard. There would be little else to change from the present course of instruction; and though, in some particulars, it might be considered desirable towards the end of their training to modify the course for boys going into the Marines, the part they had previously gone through, would not be thrown away. On leaving the training ship, the boys would be sent at once to sea-going ships; to a Training Squadron or other masted ships if possible, but if this could not be done at once, they would be transferred to such as soon as might be; and it must be so arranged that this transfer will not be delayed beyond a few months.

During the first four or five years of a seaman's service, his time would be spent, as far as accommodation permitted, in masted ships; the numbers of older men in such vessels being restricted as much as possible, and no Marines being taken. The mastless ships would take the men of four years and upwards. The masted ships would, of course, require a proportion of petty officers and of men over four years' service; service in masted ships should for them be considered of more value than the easier life of a mastless one, and should lead to earlier promotion; if this were not found to be in the men's opinions sufficient to compensate for the harder work, and if service on such terms in the masted ships were likely to be unpopular, slightly better pay should be attached to the various ratings of a masted ship than to the equivalents in a mastless one. The ratings of captains of tops, &c., might well be a specialty for masted ships.

The Navy now possesses sixteen or more masted ships with complements of 250 men and upwards, and capable altogether of accommodating over 5,000 seamen. These vessels are for the most part of steel or iron; a few are composite built, and all of them may be made to last for many years—probably until the wheel of construction takes a fresh turn. In addition, there are several vessels in a less satisfactory condition but which have yet some work in them, and a number of sound smaller vessels. Under the present system, when the Marines form about one-sixth or one-seventh of the crew, the ratio of seamen to Marines in a ship is about three or four seamen to one Marine; to be strictly accurate, from 2·3 seamen to one Marine in a 2nd class ironclad, to 4·3 seamen to one Marine in a 3rd class cruizer.

When the first stage in the proposed alteration of the proportions of seamen and Marines is reached, viz., the Marines forming one-fourth of the whole complement, it may be estimated that under 19,000 seamen in all will be required against about 22,000 at present. Of this reduced number (under 19,000), probably one-third, or about 6,300, will be under four years' service; so that, until the scheme has progressed, and the proportion of seamen been further reduced, the requisite training cannot come completely into operation. The total number of the seamen class and Marines for service afloat voted in 1889–90 is 28,351; and, allowing for a moderate increase, the total in the immediate future may be set down at 32,000. When the ratio of these two classes in the crews has become even, 16,000 will be the total number required of the seaman class; and, taking one-third of these as being under four years' service, there will be perhaps 5,400 seamen to be accommodated in masted ships. This is probably putting the case at its worst, as far as providing for service afloat is concerned.

For present purposes it is not necessary to go further than this, in considering the alteration of the proportions; but there is no reason to suppose that with Marines under the new organization, a much smaller number of seamen would not be sufficient in a ship than even one-half of the working crew.

It cannot be considered that at the present moment there are in employment an excessive number of ships which can proceed under sail alone, and yet the total number of seamen in them is considerable. Counting the frigates ("Boadicea," &c.), and the larger class of sloops, and omitting ironclads, the smaller sloops, gun-vessels, &c., the masted ships now in commission carry about 4,000 men of the seamen class, and, were the Marines withdrawn, they could take many more without increase to the total of persons employed.

It must here be clearly explained that it is no part of this scheme to go back in the least from the present policy as to the employment of mastless war vessels; the necessary construction of our principal fighting ships renders the use of masts and sails in them an impossibility; and in war-time masts and sails must be a useless encumbrance to vessels of all classes when they have adequate steam power, and can rely on their coal endurance.

But we seem yet to be a long way from the attainment of the need as to the coal; unless ships can carry much more than at present, a great increase in the number of coaling stations will be necessary before the difficulty can be said to be even approximately met in distant parts of the world. Vessels capable of moving under sail alone can, however, still be usefully and economically employed in time of peace, and such use will have the great advantage of giving a proper training to the seamen.

With regard to the question of the economical use of sails, it is necessary to observe that it has been shown by statistics that there is no economy; this is a striking instance of the familiar fact that statistics will prove almost anything. The reality is that for many years past there has been in the Service at large no attempt to propel

ships in the most economical way; the element of time has almost always been the overwhelming factor, and when tied to time, waiting for a breeze is out of the question. Where, however, time is not a matter of great consideration, there is abundant proof of the cheap rate at which ships can be moved from place to place under sail; and further evidence is always forthcoming from our Training Squadron.

It must also be again clearly expressed that the practice in masted ships is intended as a means to an end, and as a training preliminary to that in gunnery.

The change of conditions of naval warfare shows no sign of reaching a resting place; the introduction of liquid fuel, which looms in the very near future, alone will revolutionize many matters that are now of fundamental importance; why, then, hastily throw on one side a system which provides the best possible preparation of our fighting men, when we have to our hand the matériel necessary for the production of it?

The present Training Squadron of four ships, carrying about 800 of the seaman class, is quite insufficient for the present purpose; three such squadrons would under the new scheme be established, each spending about one year away from England, their cruizes being arranged with a view to the ready availability of the men in case of war. The remainder of the men under four years' service would be in masted ships on any station except the Channel, E. Indies, and China, and perhaps the Mediterranean; these ships, being capable of moving under sail, would be required to do so as much as the training squadrons. In all cases the life in the masted ships is to be one of activity, without being unnecessarily irksome. Whilst prolonged sojourns in port would be forbidden, the aim would be to make the period passed in this branch of the Service as agreeable as time spent in a mastless ship can be. There must in these masted ships be a sufficiency of war matériel of new patterns for the instruction of everyone; obsolete guns, &c., will as far as possible be excluded; in ships designed to train men they are better away, and their room can always be well utilized.

These proposals will, no doubt, be met by the old argument that as to the work of handling our real fighting machines, the time in masted ships would be thrown away; if time spent in executing means to an end is wasted, this may be true, but not otherwise; great ends cannot be effected without the employment of the necessary means, and, if the means cannot be provided, the accomplishment of the ends must not be looked for.

The number of seamen to be required in the future will, of course, depend on the relative proportions in the crews of ships; the actual figures will best be decided by experience, but accepting them as those already taken when considering the question of the training in masted ships, viz., at 16,000, the problem of giving to this body thorough training in gunnery will be much simplified as compared with what it would be with the present numbers. Under this scheme, all seamen after finishing their service in masted ships, say, at an average age of 23, would be required to pass through the gunnery

schools, and a proportion of them through the torpedo schools, the standard of instruction in gunnery being equal to the present one of seaman gunner; those who cannot reach the standard to be discharged to general service. From those who pass best would be selected men for further instruction and for the higher gunnery and torpedo posts. Amongst the men who fail in gunnery may be found the best quartermasters, forecastlemen, or boatmen; but otherwise their duties would be the same as those of the Marines.

The steam party now forms such an important part of the complement of every ship that its organization and discipline must be considered as bound up with that of the rest of the crew. The disintegrating influence of the present system of separate centres of discipline should be abandoned. Every squadron and every ship at sea will always have its own slight modifications of the central discipline, and it is not desirable for it to be otherwise; but naval barracks, Marines' barracks, "Excellent's" barracks, "Vernon," "Cambridge," Steam Reserves, &c., should come under one general system, as much as the five training ships for boys are worked under one; though necessary modifications for different classes must, of course, exist.

A different mode of entry of stokers is not an essential part of the scheme herein set forth; but the present system is far from satisfactory, and it is open to consideration whether a certain proportion should not be entered in the boys' training ships. Expense seems the only obstacle. In any case their first breaking in should take place in an atmosphere of general naval discipline, and not in the somewhat narrow zones it is now confined to.

The ships' police as a separate body would be abolished, except as to the Master-at-Arms or Chief of Police, who would in all cases be appointed by superior authority; the petty officers and men for the police duties would then be selected on board the ship indifferently from the seamen and Marines.

It is unnecessary to go more fully into detail than has been already done in this paper; the outline of an organization being clearly established, the particulars will in the hands of experienced men be quickly filled in to the best advantage.

A brief summing up of the principal proposals set forth by this paper is as follows:—

(1.) The number of seamen in the Fleet to be reduced to such a complement as will supply jointly all the seamen gunners required, and a sufficient number of men for the purely seamen's duties, as boat and anchor work, helm, lead, &c.: so that the reduced number may be able to receive a more complete preliminary training than at present.

(2.) This body of men to have their first service in sea-going masted ships, and as far as possible to have a training as seamen of the old sort; and then to be instructed as seamen gunners.

(3.) The Marines to be increased in numbers to supply the reduction of seamen. Their system of training to be modified.

(4.) The whole of the seamen and Marines and stokers to be under one organization so far as discipline is concerned.

A desire for unnecessary change simply for the sake of change must always be condemned; but new conditions require to be met with new measures.

From the earliest times the crews of war vessels have been proportioned and suitably trained to the duties required of them. In the old galleys, in action, the duty of the oarsmen (until the oars were of no further use) was to propel the vessel and nothing else; the motive power was controlled by a few men specially in charge of it; the remainder of the crew were for fighting.

When the use of oars was abandoned, manœuvring in battle was little thought of; the sails then required small attention; and, whilst seamen formed a small part of the crew, fighting men were the bulk. But when the result of the action came to depend greatly on the skilful handling of the sails, the soldier was practically lost in the necessarily increased numbers of seamen.

Our sails are no longer of use, our motive power is dependent in no way on the fighting men, we have returned to conditions analogous to those of the galley, and yet we retain the obsolete organization of an intermediate period. The pith of this matter is a change of duties turning on a change of motive power, and the consequent adoption of an altered organization. Our necessity for seamen is that of the galley, few but first rate; but it is from them we shall get our most active and intelligent fighting men.

Our present high standard of gunnery is the surviving product of a system *which is gone; the conditions which have succeeded that* system are incapable of supplying a like result; unless an adequate *substitute is provided, a decline of* efficiency is surely at hand.

The supply of our need is easily within our reach, and a clear *recognition of* altered circumstances should make us as ready to modify the organization of our men as we have been to change the duties they must fulfil.

Colonel MORRIS: I do not wish to set myself up in any way in opposition to Captain *Johnstone, who has given us a remarkably good paper, in which his arguments* have been very lucidly stated. I do, however, wish to differ from his *estimation of* the relative value which he has given to some of the component parts. He puts the Royal Marine *Light Infantry rather too low down in the gunnery* scale. I was a Gunnery Instructor myself for four years. During that time we *commenced training men very carefully*, and also to examine them much more carefully than had hitherto been the custom. We found that about 75 per cent. of the men had fulfilled the conditions of trained men on board ship, and Lieutenant Machonochie, Senior Staff Officer on board the "Cambridge," Captain Alexander Buller and Admiral Sir Houston Stewart, on inspection of the Plymouth Division in Naval Gunnery, said that our trained men were fully up to the average of seamen-trained men. Indeed, soon after that we found that Marines coming back from sea had been requalified by Gunnery Lieutenants, on board ship, frequently in a very slipshod manner, that is, the gunner reported them as fit, and the Gunnery Lieutenant passed them; and we had, in many instances, to protest against men being allowed to retain their qualifications so received. That is the first point. Then we have also been put very low down in the scale with reference to Marine Artillery. The Marine Artillery are very highly-instructed men; they are taught

a lot of things that we are not taught; but as regards naval gun drill, and as far as we go, our men are fully equal to them. I think I have gone into the gunnery portion sufficiently. Now, with regard to the duties of Officers on board ship. I fully endorse every word that Captain Johnstone has said about the Marine Officer on board ship having nothing to do, although there are many things that he is fit to do and anxious to do, and for years and years our minds have been revolting against this enforced idleness. With regard to the entry of Officers, we now get our Officers from those who qualify for Sandhurst. We get many who only want to pass through the Marines in order to go to the Indian Staff Corps, &c. I know that is the case, because I have seen many letters to that effect. If Marines are to be merged in the Navy, we shall then know who are our masters, which will be a great thing for us. Why not let midshipmen and Sub-Lieutenants volunteer to undergo a thorough and proper examination, and then be turned into Marine Officers? Sir Evelyn Wood was a Sub-Lieutenant, or something of that kind, in the Navy, and he has made a very good soldier Officer. Why should not a naval Sub-Lieutenant or a midshipman make a very good Marine Officer? then he will be able to go on board ship and do his work thoroughly well afterwards. Lord Dundonald joined the Navy at eighteen or nineteen, and he certainly was not a duffer. I may remark, in passing, that I do not like the reflections made upon the stokers. I am Admiralty Recruiting Officer in London, and I may say that we get as good men as we want, and if the authorities would only make up their minds as to whom they want and when they want them, we should be able to supply them regularly with remarkably good men; but as it is, one day they shy at a Hercules and the next day they swallow a pigmy. I strongly support the view of the lecturer that the ship's police should be abolished. I think it will be very much better to leave that in the hands of the petty officers and the non-commissioned officers. With regard to the discipline of Marines on shore, which I understand the lecturer to say does not fit them for service in men-of-war, since he would substitute a new discipline for it, I cannot agree with him. The training of Marines in barracks makes a good non-commissioned officer. A good non-commissioned officer is the most useful person on board ship, and it is only by training him, giving him authority, and supporting him, that he is able to maintain the dignity of his position on board ship. Naval petty officers lead their men remarkably well in many cases, but in most instances they do not seem to command them thoroughly well.

Admiral Sir GEORGE WILLES, K.C.B.: I am one of those naval Officers, and I am proud to say so, who still feel persuaded that masts and sails ought to be retained for certain classes of vessels. Our lecturer has explained exactly the reason why I say so. Masts and sails in twin-screw vessels are but of little use, I admit, but why should we not have a proportion of single-screw ships? No doubt you can get moderate sailing or decent sailing out of ships which do not exceed the length of the "Active," or her sister ship, and I think that is about 260 feet.[1]

Captain JOHNSTONE: Nearly 300 feet.

Sir GEORGE WILLES: You must not go beyond 300 feet with a single screw. In a ship 300 feet long you cannot obtain these enormous speeds under steam—but do we require it? Ought not we to have a certain proportion of single-screw ships which can do their ordinary duty on foreign stations under sail? In the Pacific, for instance, is there any reason why the duty which our ships have to perform on that station should not be done under sail? I know it can on the Chinese seas. Admiral Colomb has stated it has been proved that sails are rather against ships than in favour of them; I deny that. How is that possible? If the Admiral in command makes the ships perform all their ordinary duty under sail, how can he conscientiously say that sails are a disadvantage?

Admiral COLOMB: I did not say that.

Admiral Sir GEORGE WILLES: But very nearly. Then there is another reason: where are we to get the coals from? The other day the First Lord of the Admiralty in the House of Commons said he could not send a ship down to the Creuzet Islands, in the Southern Ocean. Now a ship like the "Active" could have sailed within 100 miles of these islands, and then have proceeded under steam. There is

[1] The "Active" is 270 feet in length.

another view to be taken of all this. You may depend upon it that the restriction in the use of coal is not far distant. The House of Commons will not continue to sanction such enormous expenditure of coal in time of peace, and there is really no occasion for it. I will now say a word or two as to the abolition of what is called the separate system. I rejoice to know that there is a committee sitting at Portsmouth on this very subject. I do not agree with Captain Johnstone in the difficulties which he points out. As a matter of fact, Mr. Smith, when he was First Lord of the Admiralty, in 1879, determined to abolish the system, and I was on the committee with Admiral Hopkins, and we submitted a scheme for that purpose. We found, by forming a gunnery establishment at Sheerness, this would be very easily done. Why has there not been a gunnery establishment at Sheerness? Why is it that when a ship is fitted out in the Medway, they have to send round a body of men from the "Excellent" to carry out the necessary gunnery trials. There is no difficulty whatever about it. We have maintained a "separate system," at the sacrifice of the Service generally. Of course Admiral Hopkins and myself laid down clearly that we must maintain a school of gunnery, but it should be on a moderate scale, and all our men should go through a course of gunnery—not so long as at present, it is a great deal too long now, and large numbers of learners are locked up in the "Excellent" and "Cambridge." It is difficult to get them out again, as I well know. Now come to the barracks. I am happy to say we are to have them at last. Mr. Smith ordered barracks to be built at Keyham; the opposition to them has been something frightful. For years they were empty; now they are filled, and the Officers are all in their praise. Had Mr. Smith remained at the head of the Admiralty he would have possibly effected incalculable good. He ordered barracks to be built at Devonport; he intended building barracks at Chatham and Portsmouth, and he had ordered the abolition of the separate system. What an improved position we should now be in if he had remained in office. I must say he had at his elbow as an adviser a man for whom I have the most profound respect, that is the late Admiral Codrington. On the subject of the Marines, there is a great deal in the paper with which I entirely concur, but I do not think this is the moment to interfere with the organization of the Marine corps. I certainly think there is no occasion for having Marines and Marine Artillery as a separate corps. I do not think this is the moment for disturbing the Marines. We have got a most valuable body of men, and I say "hold on to them." We have lately read a valuable paper by Sir William Jervois, in the "Nineteenth Century," entitled "Home Rule for the Navy," and I am very much inclined to think that his scheme will bear fruit in due time. Captain Johnstone says, and truly, the Marines were established when the bluejacket was a scamp and wanted looking after, but may that day not come again if we have a maritime war? Will not the Marine corps be of as great a value as they were during the last war? I say, "Yes." As to the police, I quite agree with Captain Johnstone. They ought to have been abolished years ago in seagoing ships, where a chief only should be borne to keep the books.

Captain JOHNSTONE: Will you allow me one word in answer to Sir George Willes, as he is obliged to leave? With regard to the ships, we have the ships at the present time. I think I stated in the paper that we have plenty of single-screw ships already in existence. As to the Marines, I do not propose to abolish them. What I propose is to increase their numbers.

Sir J. R. COLOMB, M.P.: I will first refer to the reason advanced by the gallant Admiral for having masted ships—that the House of Commons, whom I admit may do very funny things, will not provide money for coal. The naval difficulties in the House of Commons have in the past very much arisen from the confusion of naval opinion, and the House of Commons might gladly escape from the expenditure of coal, if they find that there are Admirals and great authorities in the Navy who really still believe that you can carry on a war under sails. The gallant Admiral also observes that the Marines in the past originated in the necessity of controlling the scamps that were impressed into the Navy. That is absolutely true, and he then goes on to say that you must prepare, in a great maritime war, to have riffraff in the Navy again. But I say it is the very essence and business of naval authorities in this country to take such steps that you shall not have riffraff in your Navy, and I venture to submit to the gallant Admiral, that the very fundamental

principle, as I understand it, of the discussion we are now engaged in, is to so improve the organization of the Navy, as to give it that power of expansion which will secure not only sufficient men in maritime war, but that the men shall be first-rate men, and thoroughly trained for the work they have to do. Now, Sir, with regard to the observation that fell from Colonel Morris, I am not going to enter into any discussion as to the superiority in gunnery of the Marines or Marine Artillery. I think that is quite outside the question. The only thing I will observe is this: the Marine Artillery costs an enormous sum of money to give them a special training over and above almost any Service under the Crown; and one of the things which are brought out in Captain Johnstone's paper, and I am very glad that it has been so, is that this most highly-trained and most expensive corps you absolutely do not know what to do with at this minute. With regard to the argument about the admitted superiority of a non-commissioned officer of Marines over a petty officer of the Navy, Colonel Morris went on to show why that was so, and the reason he gave was a very remarkable one. It is, he says, because the non-commissioned officer of Marines is trained in barracks. But that will wholly disappear when the Navy gets, as it ought to have long ago obtained, barracks in which to train their own non-commissioned officers. Therefore the moment the Navy comes to have the barracks they ought to have, the very thing that now gives superiority to the non-commissioned officer of the Marines is equalized. The present reason of the difference is this, that a ship does not afford facilities for separating the petty officers from the men, and it is impossible to get a status of superiority, if the petty officers and men are mixed up all day long in every way with one another. Therefore I think there can be no objection to the argument of the gallant lecturer with regard to the matter of non-commissioned officers. Now I would like to touch as briefly as I can on the paper itself. I suppose it will be admitted, as I think it ought to be, that in dealing with the question of naval organization, there is one main thing we must remember, and that is that the men are for the ships and not the ships for the men, and if the naval necessities due to modern science render it imperative and inevitable that you are to use mastless ships in war, I protest against the doctrine that you are to create and maintain war-ships propelled by sail for the mere purpose of training your men in peace. I think the very first thing in dealing with naval organization is to acknowledge that the policy of retaining masted ships for the purpose of training men for service in mastless ships is radically unsound; and with regard to this matter, I would ask the gallant Officer, when he is replying, to explain the passage in which he emphasizes his argument in favour of retaining masted ships for the purpose of training. He says, "If the British man-of-war's man is, in times immediately approaching, to be equal in gun drill, in rifle drill, as a field artilleryman, or as an irregular soldier, to what he has been in times past and is now, he must have a special training; and an indispensable of this training can practically be got nowhere but with masts and sails." If that be true, the field artillery of the Army ought to be trained by masts and sails. All your rifle regiments ought to be trained by masts and sails. I may misunderstand the paper, but I cannot see any connection between the training of the field artilleryman, the training of the regular soldier, or the training of the rifleman with masts and sails. I admit the loss of masts and sails as a means for training the individual seaman is a very serious matter, and one of the problems the Navy has before it. The question is, how you are to produce the same qualities to-day as in the past without masts and sails? You cannot admit that you are to go back to masts and sails in war ships simply for the purpose of training your men. Now, I think it is because thirty-two years ago naval opinions were everywhere clinging to the old things, that the Navy is so far behind in its organization. We had the Commission of 1859, and I have already pointed out, in this Institution, that even the word "steam" never appears in the report of that Commission, and the whole of their recommendations were based on the supposition that masts and sails were to go on for ever. You were told then in the evidence of the then naval experts, and the report was based upon that evidence, that the Navy would not carry on war under steam. One of the reasons given was a reason partially advanced here to-day, that you would never be able to provide the coal. Therefore, let us be cautious, in making any change now, not to make the same blunder, and let us

frankly admit and frankly adopt the principle that masts and sails are things of the past. Now, passing to other matters, we have two great branches before us. You have the class of seamen and the class of Marines, and with reference to how this state of things was produced, I must ask the lecturer to consider one great cause of the present existence of this anomaly. I think it has not sufficiently been considered; at all events I find absence of reference to it in his paper. It is this, that in the old days you had not continuous service in the Navy, in the old days you had no real consecutive training of bluejackets. It was found that by training men you trained them to a trade that was a marketable trade. A seaman's trade was a marketable trade, and all the merchants in the world were bidding for seamen trained in the Royal Navy; and, therefore, you first caught men for three years only, and you then trained them to be seamen, and at the end of three years they carried their trade to other markets. The result was you were compelled to go to continuous service. You had then to maintain two different Discipline Acts—one for continuous service—the Marines, and one for non-continuous service—seamen. The Navy required a different Discipline Act, being a non-continuous service, from the Marines, who were continuous. That is a very important point to bear in mind, but now that reason has entirely disappeared. There is no difference now in the duration of service, as men are enlisted as long for the Navy as for the Marines, therefore there is no practical difference between the two. But when you come to the solution of this anomaly, you find this extraordinary state of things, you come to an absolute deficiency of trained naval Officers of the rank of Lieutenant and other ranks. You have at the same time a great body of Marine and Marine Artillery Officers, but not being trained as naval Officers, you do not know what to do with them. There it is, and therefore I am most heartily in accord, and I put it forward years ago in this Institution, that the Admiralty arrangements and the policy of the Navy should be to fuse the two bodies, and to bring them into line together. The whole tendency of circumstances is to bring them together, and it is only old regulations, training, and prejudice that stand in the way. I am, therefore, most heartily in agreement with the general views of the lecturer with regard to the importance of increasing the naval training of the Marine forces, and above all things of making your Officers of Marine available for general duties on board ship. While agreeing with the premises of the lecturer, I differ somewhat from his conclusions, and I think the difference lies in this, that I refuse to contemplate the reorganization of the Navy from such a narrow basis as he does. He rather takes the ship as the unit from which you are to work; I prefer to take the general duties to be discharged by the whole Naval Power of England, and I think, in proposing the changes he has, he has omitted those broader considerations. The considerations that we should keep in view are these: first, you have to consider the personnel employed in your active fleet; you have to consider, secondly, the personnel of the Reserves for that fleet, which must be maintained; and, thirdly, you must consider the personnel of trained fighting men as Reserves, available for service on board mail steamers, and the great steamers running up your lines of communication; and, fourthly, you have to consider the necessity involved in all naval operations, that is, the minor military operations, in seizing and holding small posts without denuding the fleet of the men that are necessary for the fleet. Therefore, if I differ from the lecturer at all, it is simply that I wish he would look a little further into this matter, and I think then that he would see that what he dismisses as apart altogether from the subject of the paper—or rather incidentally and mysteriously refers to—is the garrisoning of all your ports and naval bases by a force under the Navy. Perhaps the force might be more naval than marine, but still such a military force is very germane indeed, and an essential part of the organization of the Navy. I trust that this subject will be kept alive by naval Officers, because I think it is want of organization which is weakening our Navy, and I think the money that is going into the Army might be applied to the Navy, and with greater advantage to the State if the Navy would only make up its mind what it wants and determines to get it.

Captain CURTIS: I presume that what Captain Johnstone wants is to give our fighting men a sea-stomach, and a sea-stomach cannot be given in barracks. It is very evident that it must be given on board ship. With respect to coal, I may say

I have just come from Vancouver, where I have been for fifteen months. There is any amount of coal there, but on any other part of the Pacific station you may have to go to the Falkland Islands for coal in time of war, and I believe it is for that reason that they have just divided the station into two parts, viz., North and South Pacific Stations. Seafaring men readily adapt themselves to circumstances. In the first ship I went to sea in, in 1841, "The Queen," 110 guns, the second gunner's mate was a Royal Marine Artillery pensioner: Marines shared boat duty and duty as prize crews, furled the lower sails, and did other duties with the seamen. My experience has been that the able seamen and petty officers were quite equal to the seamen gunners as experts in target firing. On one occasion, at the gunnery inspection, on paying off the ship, the quarters I was in command of were ordered to fire three rounds quick firing, at a fixed object in Plymouth Sound; at the second round the Inspecting Officer ran his eye along the sights of one gun, and said the gun had not been correctly laid. I replied, "Sir, the captain of that gun is a Gunnery Instructor," whereupon the Inspecting Officer smiled. I speak subject to correction. I have been informed where Marine Artillery Officers are borne on ships' books they usually are in command of one of the important guns or battery; the Marine Officer of H.M.S. "Calypso" in 1846 had charge of the forecastle gun—a pivot-slide gun. Gymnasiums on board ship are a poor substitute for practical seamanship, they may help to develop the muscles.[1]

Admiral P. H. COLOMB: I think this is a paper which was bound to be read at some time or other. I am surprised myself that one such has not been read before. I am nearly sure it will be followed by many others now that the ball has been set rolling. With most of the premises of the lecturer I am inclined to agree, but I am not sure that I reach from his premises his conclusions. One of his premises, in fact, his leading premise, I think I am bound I won't say to disagree with, but to say that it is not proved; it has been already alluded to by Sir John Colomb, and is the statement that, practically, a man cannot be a good seaman gunner unless he has first had good practice with masts and sails. It may be so; it is constantly asserted that it is so; it has been said over and over again in this theatre; but I have never met anybody yet who has attempted to offer the slightest proof of the fact. And the lecturer himself offers no proof; he makes the assertion, and is confident that the majority are with him, because the majority are always asserting it. The theory is that practice with masts and sails gives that quickness and power and training of mind and limb together, which are required to make a perfect seaman gunner. I will ask you to consider in your minds what kind of man, after the agricultural labourer, most fully represents the dulness and stolidity of humanity, and I think you will agree with me when I put it to you that the dullest man, after the agricultural labourer, is the merchant seaman immediately after he has come down from furling an upper topsail, with his sea-boots on. I do not believe for one moment that the drilling of masts and sails has any effect upon the goodness of the seaman gunner. I know, first of all, that the seaman gunners in the Navy are not chosen, and they never have been so chosen, as far as I know, for their activity aloft; they are chosen, at present, entirely for their character, not from their abilities as seamen aloft. Then there is another point; it is quite the custom to say that masts and sails have made the seaman; but my experience on board ship is just the opposite way, that the men who are chosen to take the upper places on board ship are active first, and then placed in those positions afterwards; that to a certain extent you are putting the effect before the cause when you say that the smart seaman or the smart seaman gunner is produced by his work on the upper yards of the ship, because it is only on the upper yards that those qualities of mind and brain combined are called forth. And, then, I have to recollect in old days when there was a seventh gun's crew on board the "Excellent," that was the Officers' gun, and it almost invariably beat the seamen's guns. The Officers, no doubt, most of them, had had some little practice aloft, but nothing to speak of, but how was it that those Officers who were not trained aloft should always beat the seamen who *were* trained aloft? Then, again,

[1] There is no doubt with our battleships very highly trained men, or Officers, and men of well-known nerve will be chosen to control the heavy battery guns.

the lightest and sharpest and brightest trained military people I have ever met in my life, whether soldiers or sailors, are the Italian Bersaglieri. They are peculiarly light and quick in all their movements, but they have had no training aloft. I believe that what has made the British seaman at present what he is,—and, mind you, the British seaman of the present day is a much smarter, lighter, and more intelligent person than he was forty years ago when he was full of his sail drill,—is not the masts and sails, but it is the naval training, the habit, the custom on board ship of timing everything; so many Officers, with their watches in their hands, measuring the time in which everything is done, which practice does not exist anywhere else. It is that that has produced the sharpness and quickness of the man-of-war's man. But supposing it were so, that it was a necessity for our seamen gunners to be perfect, to undergo a long training with masts and sails, what is the logical conclusion? Surely it is not to put them into steam vessels with masts, where there are all sorts of inconveniences to interfere with their drill aloft. You are bound, if you act logically, to provide sailing vessels for the purpose of training these men, and I am not at all sure, if the lecturer is right, and it is a necessity to have this sail training, that it would not be worth while to build sailing ships for the purpose. There would be duties for them to perform which they could very efficiently carry out in peace, and very economically. All the transport work, all the store work, and taking out the crews to ships abroad, of which so much is done now, could be carried out in that way. I do not say it ought to be, but I think that it is the logical conclusion to which the lecturer ought to have come. I know myself, in masted steamers, it has always been a toss-up what amount of sail training a man got. Some Captains would never give them any training at all, others were constantly under sail. The other general premise is very plainly and clearly stated in the paper—the constant assimilation which is going on between the bluejacket and the marine. There is continuous service, which brings him a step nearer. Now, you have barracks which brings him many steps nearer; you have done away with masts and sails which brings him many steps nearer, and you are training him now in a way to make a very first rate soldier. You are continually bringing, in spite of yourself, the seaman up to the marine, and the conclusion I should come to is not that which the lecturer comes to. You must observe that he proposes to accentuate more strongly the difference between the seaman and the marine. I think that what we are coming to is a greater drawing together of those two branches of the Navy, that is to say, that while you are now "soldiering the sailor," if I may use the term, what you will have to do presently is to "sailor the soldier," so as to bring the marine down nearer to the bluejacket level, and I do not think that ultimately there will be any difference whatever between the seaman and the marine, or between the Naval Officer and the Marine Officer. That I believe to be the logical conclusion of the premises set out in the paper. I was glad to notice the lecturer putting it forward clearly that it was not the value of the marine as a soldier, but as a man on board ship, that we should enhance. Sir John Colomb, I am glad to note, put forward most of the views I hold on this subject. We had no consultation as to what was to be said beforehand. I can only say I have fully concurred for years with his views, as he has put them forward again to-day. But, then, I am not absolutely clear as to what the meaning of the lecturer is, what it was exactly that he is aiming at. I trust he will correct me if I am wrong. I understand that what he really wishes is to keep up masted ships, manned wholly with seamen, as a necessary part of the training, and that all that he proposes to do is to increase the Marines sufficiently to take the places of the seamen who are withdrawn from the masted ships. Now, that is not a very big proposal, but I think the premises which are put before us point to much larger conclusions than that. As I say, I think the conclusions which ought to be drawn from the premises put before us in this paper are that we must look to the complete amalgamation of the two branches of the Service, so that there shall be no difference between the seaman and the marine.

Colonel J. M. Moody, R.M.L.I.: Mr. Chairman and gentlemen, after the eloquent speeches that we have heard, I feel great hesitation in following up the discussion. I have listened to the able paper just read with much attention. With some portions of it I thoroughly agree, with others I totally disagree. I think if

Captain Johnstone had been recently at one of our gunnery headquarters, and seen a little of our system, he would not have rated us quite so low in gunnery. The efficiency of the R.M.L.I. in naval gunnery since Colonel Morris and myself held the appointment of Gunnery Instructor has greatly increased; the increased efficiency being due in a great measure to the trained pay having been granted to the corps; 80 per cent., roughly speaking, of the non-commissioned officers and men qualify as trained men. The system of gunnery training at headquarters is most carefully carried out, and I am informed by gunnery Officers that the result is all that is wanted for naval purposes; I think, therefore, that the Marines should be classed higher than "other seamen." In listening to the paper, it occurs to my mind it may raise in the Marines a feeling of distrust. For many years, the corps lived under a constant fear of being disestablished; very many naval Officers, some very distinguished ones, whose opinions had great weight, held that the Marines should be abolished, and did all they could to carry their ideas out; fortunately wiser counsel prevailed. The effects on the corps by this agitation was to engender a sense of insecurity and distrust, which tended greatly to lessen efficiency; is it, therefore, not advisable to leave a good system, and one which works so satisfactorily, alone? The Admiralty and I believe the Navy generally are satisfied with the discipline and efficiency of the corps as now constituted, and there is no difficulty in keeping it up to its full strength. Begin to discuss radical alterations, and you destroy the confidence of Officers and men. It is recognized that the purpose for which the marine is created is for naval service, and his training should therefore be to make himself, in the first place, as useful as possible to the Navy. But there is another point which should not be lost sight of, and that is his utility for Imperial purposes; not only has the marine to serve on board ship, but in many instances we know that he has to serve on shore. So long as the country has a large number of Colonies, and a vast seaboard, he will be required for land service. I therefore strongly urge do not lower his qualities as a soldier, make him as useful as you like afloat, with this always in view, that he may at any time be called upon for land service, utilize him to fill the artificer and other ratings for which landsmen were wont to be entered. The system was begun some years ago, and may with advantage be carried further: provided that the corps is increased sufficiently to meet the additional requirement, more of the skilled artificers' ratings might be filled by Marines, even if eventually they were transferred to the Navy entirely. Were it known that artificers were required for the Royal Marines, there would be an ample supply, as there is in the Royal Engineers; the soldierly qualities of the men do not suffer by such employment, either in the Marines or Engineers. The lecturer raises the question of assimilating the Marines' clothing with the blue-jackets. I may just mention one of the grievances put forward by some men of the Army Reserve, which was that "the Austrian knot had been removed from the cuff of infantry regiments"; if such a small matter should dwell on men's minds, what might it not be, if not only the shape but colour of the Marine uniform were altered? We should most likely be landed in the same difficulty as the Army are in for recruits, if such assimilation took place. As long as we have a voluntary system of enlistment in this country for the public services, we must study these things. We have now no difficulty in recruiting for the Marines, and so long as that is the case great care must be taken not to make radical changes. As regards the Marine Artillery, we all know what the Marine Artillery are; they are a magnificent body, splendidly trained, fit to do anything and go anywhere, and yet it is very sad to hear that these men have no sphere. With the Officers, non-commissioned officers, and men so well educated and highly trained, it would not be encouraging for them to hear the opinions expressed to-day in relation to their usefulness to the Navy. If this is the general opinion of the Naval Officers, why is not a sphere found for them? Sooner or later, the Coast Defence must be undertaken by the Navy; does it not appear that the Royal Marine Artillery were created for it? This Coast Defence question must be faced, and the sooner the better. Here is a body already at hand for the purpose. It will be said why should the Naval Estimates be saddled with the expense which is now met out of the Army Estimates? This would be unfair; but could there not be a sum voted, say, for Imperial purposes, and not included in either Army or Navy Estimates? Let it,

however, be administered by the Navy, and allow the Royal Marine Artillery to undertake the work of Coast Defence; it would be found that it would be a great saving to the country, a good system ensured, and a splendid body utilized. The lecturer has alluded to Lord St. Vincent; I believe it is generally admitted that had it not been for Lord St. Vincent, England most probably would not be now a First-class Power. He regenerated the Navy, and thus saved the country; he was one of those men who appeared to have had an intuitive knowledge of what was right; he recognized the usefulness of Marines and their sphere of action; he was a man, I think, that always held to the principle of "the gunner to the linstock, and cook to the foresheet," and I think that we should still stick to that principle as much as possible. Let the gunner help the cook, and the cook help the gunner; but do not try to make a man jack of all trades but master of none. As regards the employment of Marine Officers afloat, they will only be too glad to be more useful if they have the opportunity given to them to perform duties for which they are qualified.

The CHAIRMAN: With reference to the Marines and their training in gunnery, I can say, from my own experience, that I commissioned a line of battle ship, which was not exactly as Sir George Willes said, full of rogues, but it was full of landsmen. I do not believe there were a dozen men of the seaman class who had been in a man-of-war before. I was glad to employ the Marines as captains of guns at first, and also to employ one of the young Marine Officers, who had lately gone through a very creditable course at Hythe, to train these landsmen in the rifle drill. The men were trained at the guns under the supervision of a first-rate gunnery Lieutenant, and the Marine Officer trained these young landsmen to use their rifles in such a way that after two or three weeks, when they began to fire at targets astern, they fired a great deal better than the old man-of-war's men, although these latter could do their manual platoon with the greatest possible precision. I should not, therefore, like to admit that the general training of Marines in gunnery was inferior to what you might reasonably expect from our own men. Reference is made by the lecturer to its being absolutely necessary, if men are to be highly trained in gunnery, that they should previously serve in masted ships. The lecturer has put it very clearly in the shape of a syllogism. First, it is very necessary that our men on board ship should be thoroughly trained in gunnery; secondly, it is found that the best training in gunnery is given by working ships with masts and sails; and the conclusion is, therefore, that men who are intended to be seamen gunners should be first trained to work ships with masts and sails. It is afterwards proposed in the lecture that a classification of the crew should consist of: First, those seamen gunners who, having been trained in sailing ships, have attended the gunnery and torpedo school; a second class, who are not so highly trained in gunnery, should do the ordinary sailor's work, boats, &c.; and a third class who should do the remaining work. Therefore the proposal is that men who are intended to reach the highest standard in gunnery should pass four or five years in a seagoing sailing ship, removed from all the gunnery practice in the larger sense that is connected with naval artillery, and then, having learnt all the seamanship in sailing ships, they should not afterwards practise it, but be reserved entirely for gunnery. I think the lecturer has endeavoured to discriminate and to divide in these arrangements more than is necessary, otherwise the lecture is one that will meet with everybody's approbation. I should say that I myself am one of those who have thought for many years that all the seamen of the Navy should be trained to be seamen gunners; that the exception should be a man that is not a seaman gunner. But then I use the word "seaman gunner" in the sense in which it was originally used in the early times of the "Excellent," before which there had been no system of gunnery. It was then necessary that the "Excellent," after compiling a general system of gunnery should train some men for the purpose of teaching the others, and they were the seamen gunners. Every man ought to be a seaman gunner now, because every man ought to know the gunnery system. There are a few higher men qualified as trained captains of guns; but, otherwise, I do not quite agree with the lecturer that we ought to keep up two classes, one of seamen gunners and the other of non-seamen gunners, in the Navy.

Captain JOHNSTONE, in reply: Colonel Morris and Colonel Moody have thought

that the paper places the gunnery qualification of Marines too low. Whether that is so is a matter I must leave to be decided by other opinions. My own estimate is, if the Marine Light Infantry man is placed on a par with trained men he is not in a bad position, and certainly it is not looking down upon him, as far as gunnery qualifications are concerned. I think it is putting rather a high value upon his gunnery qualifications, at any rate that was my intention. Colonel Morris mentioned that I said the training of Marines on shore was a bad thing. I think that is quite a mistake; that certainly was not my intention. I said particularly the discipline of the Navy was nearly as good as that of the Marines, and it will be quite as good when they have the same opportunity that the Marines have. My view is quite the other way. I think there is nothing equal to the non-commissioned officers of Marines we have on board ship. I have never seen any discipline in the profession like it. A good non-commissioned officer of Marines is certainly the most useful man you can have, and I shall be very glad when we can safely say the bearing of our petty officers generally is equal to that of the non-commissioned officers of Marines. Sir John Colomb said, the men for the ships, and not the ships for the men; but my contention is, if you are to work your ships properly, you must have a better sort of men in them. It is no use expecting to have the best sort of men, if you do not give the men the best opportunities for becoming so. Admiral Colomb also alluded to that point, and said there was no proof at all that an indispensable part of training to seamen was that with masts and sails. My contention is not that he cannot become a good seaman gunner if he does not have training aloft, but that if you were to have him very good, that is, as useful as he is at the present time, you must take the same means. There is nothing to show you cannot get the same sort of men if you carry on the same kind of training you have at the present time. There is a particular class of training, and unless you have that particular class of training, I certainly think there is nothing to lead us to hope even that we shall have the same sort of men. Admiral Colomb also said he believed the quickness of our men was due to the fact of their doing everything with their Officers standing watch in hand. That is perfectly true, but then the great point is, in modern ships you have no means of competing. In the first ships that came out without masts, it was proposed, instead of crossing the upper yards and so on, to have, as an eight o'clock evolution, shooting off a torpedo, or something or other. Of course it was not the same thing. Every ship now is different: there are no two ships alike; there is no standard you can possibly establish for quickness. I really do not see how you are to do anything of the kind, you cannot possibly compare them; whether it is getting up anchors, or whatever the drill may be, there is no possibility of comparing them, whereas in the old standard of masts and sails there was no mistake about it. If there was any difference in the fitting of a ship, every person in the fleet knew it perfectly well, and how much allowance was to be made for it; if one could not ship her topgallant masts, the other could not shift her topsails so well; but at the present time there is no possibility of competition, as far as I am aware, and that is one great point. With regard to the Officers' gun beating the seamen's, I do not think that proves very much. To begin with, the most efficient Officers in these days have been trained aloft, and a smart top Midshipman would be very sorry if a royal yardsman could beat him going aloft. Besides, the men have not the same thing to struggle for as the Officers. The Officers have to determine to keep their position, therefore, the Officers' gun is bound to be first. We know the Officers have greater endurance than the men. In the Arctic Regions the men used to give in first, not the Officers. With regard to Colonel Moody's further remarks upon the paper, of course it is not very easy for me to answer them, because he took an entirely opposite view on several questions I put forward, and, therefore, there is no reply to be given to them. No doubt Lord St. Vincent was a very clear-headed man, and certainly the corps *par excellence* in his idea was the Marines, because the Marines were most useful, but he carried it so far that he wished to have the whole army Marines. I do not think we can exactly hold Lord St. Vincent as being perfect in his ideas on this point. It is related of him that he objected to vaccination because he thought small-pox was a means of Providence for keeping down the surplus population. That is not quite in accordance with our views in the present day. I fear I have not made it quite

clear what the intention of this paper was. Perhaps I might explain. The idea is that all our men should be seamen gunners, that every man who is called a seaman should be a seaman gunner, that we should not as at present have part seamen gunners and part not seamen gunners, but that they should be all actual seamen gunners and not a modified form of seamen gunners, that it should not be a shortened course, but that they should be thoroughly instructed to the same point as the seamen gunners are at the present time, and that every one should go through it. At present that is impossible; you cannot put the whole of the men in the Service through the gunnery ships, and give them the same seaman gunner's training at the present day; at least, if it is possible, I do not see myself how it could be done; but if you reduce the number of seamen the matter is simplified at once. If you have a larger number of Marines, whom you train on shore in gunnery, and I think their system of training is excellent, but I wish there was more of it; if you reduce the number of seamen and have a larger number of Marines, you will at once be able to put the seamen through the gunnery ships in the present way. Those who are too stupid, and cannot come up to the seamen gunners' training, because there are some who are discharged from the gunnery ships because they are unable to come up to the standard, this sort of men you must discharge. They must go back into the fleet as general service men. Then, as at the present time, men will be selected for gunnery instructors and torpedo instructors, and many positions which require very superior training to what they have at the present time. The Marines would have a higher gunnery training, and they would fill up and actually make up the number of seamen who were reduced. There is another remark of Admiral Colomb's which I do not think I quite answered. Admiral Colomb thought my object was to take Marines out of the ships that had masts, and merely put seamen into them. My object was not that: it was to reduce the seamen to such a number that you could get them all conveniently through the gunnery schools, and unless the numbers are considerably less than they are now, or there is a great increase of gunnery schools, I do not see how that is possible to be done.

The CHAIRMAN: It now only remains for me to ask you to give your best thanks to Captain Johnstone for his very valuable paper. I hope it will lead to a considerable amount of opinion gaining ground in the Service, connected with the subjects he has brought before us.

MILITARY PRIZE ESSAY.

"THE TACTICAL OPERATIONS OF THE FUTURE (INCLUDING QUESTIONS OF SUPPLY AND TRANSPORT OF AMMUNITION) AS AFFECTED BY THE INTRODUCTION OF MAGAZINE RIFLES, MACHINE AND QUICK-FIRING GUNS, AND SMOKELESS POWDER."[1]

By Captain G. E. Benson, R.A.

"Nullius in Verba."

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[1] The Essay has exceeded the estimated length, but in consequence of the importance of the subject, it has not been thought desirable to shorten it.—ED.

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SMOKELESS POWDER.

IN considering the effect of the use of smokeless powder on the tactics of the future, there is no war experience to guide us, and, beyond the effects noted at the manœuvres of some European armies, there is little to assist our researches except the imagination. The impressions of those present at the Continental manœuvres are therefore extremely important, especially as it seems more easy to realize the effect of smokeless powder in war from mere manœuvres in peace than that to be produced by magazine rifles and machine-guns, the reason being that in the latter case, the highly strung state of men's nerves in battle and its effect on shooting is a factor impossible to take a correct estimate of when no bullets are flying about. We therefore cannot do better than quote a few impressions of those who took part in, or were present at, the German and French manœuvres of 1889 and 1890.

Impressions gained at recent Manœuvres.—Of the German manœuvres of 1889, when two corps opposed each other, the one with

black and the other with smokeless powder, a German officer[1] writes as follows: "The powder being nearly free from smoke, allowed the marksmen to take better aim than was possible with the old powder, especially in damp atmosphere without wind, when the smoke lay on the ground and formed almost an opaque wall between the marksman and his object. A better aim, easier judging distance, quicker firing on sudden appearance of large objects, as for instance, supports, columns, advancing batteries, cavalry, &c. . . . . all this was facilitated by the use of smokeless powder."

On the same subject Mr. G. Saunders[2] says:—

"Summing up the results of the day as affected by the use of smokeless powder, it exercised a most demoralizing and bewildering effect upon the troops exposed to infantry fire. Further (1.) The enemy (using black powder) experienced extraordinary difficulty in determining (*a*) the distance, (*b*) the direction whence the fire came. (2.) The smokeless powder gave the Army Corps which used it a greatly increased certainty of aim arising from the absence of smoke from their own fire. This was especially asserted in the case of the artillery. It was freely stated that on this account the artillery were able to fire twice as many rounds as in the same period with the old powder. (3.) When the infantry was firing, brown smoke was faintly visible from the flanks; facing their fire, no smoke or next to none could be perceived. On the 20th and 21st September artillery Officers were freely declaring that the new powder weighed half as much as the old, thus enabling double the quantity (of blank) to be transported."

The military correspondent of the "Times" (September 16th) at the French manœuvres of 1890 confirms what was observed by Mr. Saunders as to the invisibility of smoke of infantry fire from the front at distances beyond 50 yards. A German officer writing in the "Militär Wochenblatt"[3] says: "Our regulations, both for fire and drill, have now laid it down that all considerations as regards cover must be subordinated to fire effect. So that now it can no longer be urged, in opposition to smokeless powder, that it fails in giving good cover to the firing line in the way the smoke of the black powder did. In fire action now, in accordance with the principle quoted, the men must think how best they can get the fullest fire effect and not how they may most securely find shelter; . . . . . if one side can command the services of smokeless powder it will see better, aim better, carry out its fire discipline more perfectly, and, finally, produce a greater fire effect."

General Considerations.—Hence the superiority of smokeless powder, which will cause all nations to adopt it. The arming of troops with magazine rifles and the introduction of machine-guns makes its adoption still more necessary; for how are men to fire rapidly a magazine full of cartridges with anything approaching accuracy when

[1] Major Rogalla von Bieberstein, "Colburn's U.S. Mag.," February, 1890.
[2] "The Last German Manœuvres." Lecture at R.U.S. Institution, 13th June, 1890.—("Morning Post," 16th June.)
[3] "R.A.I. Journal," November, 1889. (Translated by Captain May.)

at the first shot their front is obscured with smoke which increases at each discharge? What sportsman, shooting with black powder, has not experienced the mortification of being unable to put in his second barrel owing to the smoke caused by the first?

On the other hand, the curtain of smoke gave a certain amount of confidence to the firing line, which apparently felt a sort of security (of the ostrich description) behind it, and the smoke hid some ghastly sights from the men's view which will now be more visible. The moral and invigorating effect on the soldier of firing off his weapon and producing a cloud of smoke was considerable, and many are the instances quoted in recent wars of men shooting to keep up their courage. It seems likely the noise and smoke had a great deal to do with this. The noise (slightly decreased) remains, but the smoke has gone, and the opposing lines will be able at decisive ranges to see each other face to face.

Smokeless Powder not Noiseless.—For some time there existed a general idea that smokeless powder would be more or less noiseless, and still further complicate the problem of its effect on the tactics of the future. But those who have heard it know that this is an error, and we may take Sir F. Abel's[1] word for it, that such a powder is not likely to trouble us during the present generation.

Having, so to speak, prepared the way for thinking out the effect of smokeless powder, the various operations of war as affected by this new element will now be examined.

Effects of Smoke.—The effect of smoke is that it hides everything, and once in the thick of the fight practically nothing is seen. Remove the smoke, and the enemy is exposed to view if within decisive range; if not, then the ground where he is is likely to be seen.

Combatants may be divided into two categories—

(1.) Bodies of skirmishers, batteries in action, and all units in the act of firing are inconvenienced by their own smoke.

(2.) Bodies such as columns of supports, reserves, batteries in motion and cavalry, and all troops which are not firing benefit by smoke, but in the way of cover only.

But it is acknowledged now that all considerations of cover must yield to those which favour efficacy of fire. In short, as Captain Moch[2] puts it: "To see is of the first importance in battle, and, after that, not to be seen." If unable to see, not only are men unable to fire properly, but owing to the uncertainties consequent on not being able to see, they are much more liable to sudden panic. Like men in the dark they conjure up dangers which do not exist.

Infantry v. *Infantry.*

However perfect may be the fire discipline of infantry, its fire effect depends more on each individual soldier than is the case with artillery. This must always remain true, since artillery Officers

[1] "Engineering," 7th February, 1890.

[2] "La poudre sans fumée et la tactique," "Revue d'Artillerie," tome XXXV.

have far fewer units of fire to deal with, and have, as a rule, to exercise their control at a much greater distance from the enemy. As infantry advanced to the attack, the position of the enemy was disclosed to it by the smoke of his fire; but when the attackers opened fire, very soon the enemy's position was hidden from them by smoke. The enemy was thus first of all seen and then not seen. In the future, the reverse will be the case. Attacking infantry has to feel its way, and, perhaps, on arriving within 400 or 500 yards, it will see the enemy face to face. When this takes place, the side which can develop the greatest and most efficient fire will win the day. Over open ground, the attacking line can advance no further until the fire of the stationary or defending troops is almost subdued, and the intensity of fire necessary to produce that effect is so great that before the attackers advance the defenders will most probably have retired. The only case where that seems unlikely is, when the ground in rear of the defenders is not only swept by fire but is in full view of the attackers; as, for instance, when their only line of retreat lies up a steep slope in rear. In this case nothing will remain for the defenders, when completely cowed and demoralized, but to surrender. There will no longer be a screen of smoke, under cover of which the retirement can be effected unseen. On the other hand, the supports and reserves of the attackers being in future unhidden by smoke, the task of the attackers is much more difficult, and they will have to deploy earlier and make more use of the ground as cover. It would seem, therefore, that the frontal attack of infantry by infantry, even in much superior force, over open ground, is rendered much more difficult than formerly (during daylight) by the introduction of smokeless powder, the quality of the troops on both sides being equal.

Effects of Terrain.—In broken or enclosed country where much cover is available the case is different. Here advancing infantry can be concealed, and its presence even is no longer betrayed by smoke. The attackers may thus push forward superior numbers, and, unless considerable physical obstacles intervene, they have great chances of success. In such ground the attack and defence are placed on more even footing, and the absence of smoke conceals the strength of the attack as well as of the defence. Thus, victory will belong to that side which is strongest, can shoot best, and in which the control and fire discipline is the most perfect. Probably many cases will arise where friendly troops are mistaken for those of the enemy, for often the direction of the puffs of smoke shooting out from the rifles used to be the only guide for the moment as to whether they proceeded from friends or foes. For the same reason, local flank attacks will probably become more startling in their results owing to there being nothing to indicate whence the sudden shower of bullets proceeded.

Effect on Fire Discipline.—As regards fire discipline and control of men, the task of the commander of a unit will be facilitated by the absence of smoke, for (1) no longer blinded by smoke at decisive ranges, he will see better where to direct his aim; (2) he will see the whole of his unit, and consequently can hold the men better in hand;

(3) he will see the neighbouring units, and the better conform to their movements; (4) if killed he will be seen to fall, and the second in command can at once take his place. In these particulars the advantages pertain equally to the attack and defence.

Artillery v. *Artillery.*

The smoke caused by artillery fire being so much thicker than that of infantry, it would appear that smokeless powder will benefit the former arm to a proportionately greater extent. There are also no supports and reserves in the case of artillery to hide from view by smoke, the limbers and wagons being generally concealed by the ground.

Effects of Smoke.—The effects of smoke on artillery may be classed as follows:—

(1.) Smoke interferes with the laying, and frequent stoppages of fire have to take place to allow it to clear away.

(2.) Smoke discloses the position of every gun to the enemy, and therefore assists his accuracy of fire.

(3.) Smoke hides the immediate front of the line of guns, and may thus assist hostile skirmishers to creep up unseen.

On the other hand, (4) it hides movements from the enemy; and—

(5.) It makes his observation of fire in the case of long shells more difficult, for the bursts become confused with and lost in the smoke of the guns.

Nos. (4) and (5) are evidently not of such importance as the rest, for, in these days of long ranges, the movements of batteries on the battlefield are not so frequent, and the difficulty of observing bursts short and over is probably greater when the guns are judiciously placed and no smoke betrays their position.

Effect of Absence of Smoke.—The absence of smoke, however, will probably cause a former favourite manœuvre of artillery to be discontinued.

Sometimes, under an accurate hostile artillery fire, batteries advanced 100 yards or so under cover of the veil of smoke, and came again into action without attracting attention, thus causing the enemy to continue his fire at the original range. This will no longer be possible.

With a mass of guns in action, the smoke is so thick, particularly on damp still days, that it is a most difficult matter to lay the gun, much less to observe the fire. Hence, effectual concentration of fire must be very difficult to carry out. The absence of smoke, therefore, improves fire control and accuracy when laying on defined objects. It makes it possible to fire much more rapidly, as stated above (p. 397) by German Officers, on account of no check in the fire being necessary. It makes it very easy to mask batteries behind bushes or carefully placed epaulments, and thus gives a much harder task to the enemy's guns. A "Times"[1] telegram from the

[1] "Times," 26th August, 1890.

scene of the Italian manœuvres this year states that batteries remained in action for half an hour without being seen. On low ground this may often happen, but generally the crest of a ridge will partially define their position. The "Times" correspondent at the French manœuvres near Cambrai[1] says, "that at 2,500 yards a specially brilliant flash was observable with the naked eye, but no smoke. With a good glass, however, a puff of smoke, which almost immediately disappeared, was discernible." Later[2] on, however, he corrects this by saying that this puff was dust and not smoke. Hence dusty ground is a disadvantage.

The front of a line of guns will now be more secure, as skirmishers advancing over open ground will easily be seen. Prince Kraft[3] tells us how, at Königgratz, when the artillery were trying to beat each other down, the Austrian gunners did not notice the Prussian skirmishers followed by close columns, advancing against their front through the corn across an open valley. The result was that most of the guns were captured. This is not so likely to happen in future, however absorbed the gunners may be in their fire, so long as the ground in front is fairly open.

By reason of the smokeless powder cartridge being little more than half the weight of the old cartridge there is a saving of about $1\frac{1}{2}$ lb. to 2 lbs. per round in the 12-pr., which means that nearly 10 per cent. more rounds can be carried, unless this saving of weight be used to provide brass cartridge cases.

It is probable also that the absence of smoke may, where the ground admits (as on a frontal slope) and where great concentration of fire is desirable, enable two tiers of artillery fire to be brought to bear, the more forward batteries being of course out of range of prematures from those in rear. As regards supporting an infantry attack, the gunners will be better able to see their own infantry advancing, and will not run the risk of keeping up the covering fire too long and killing their own friends.

The result of all this will be that it will become of great importance to pick out men with good vision, who, with the assistance of field glasses, telescopes, and other aids to sight, may be able to make out the position of the enemy's batteries, and observe the bursts of shell with reference to them. As his guns will present no such defined objects to lay on as formerly existed in the puffs of smoke, the flashes being more deceptive than smoke, points such as trees, houses, or smaller objects, will have to be chosen for regulating the fire by, when once their relative position to the hostile guns is made out. Thus, layers, no longer tempted to lay on the smoke, will be more in the hands of the commander of the battery, and will look to him to name the object to fire at. The difficulty the latter will experience in pointing out the object will, however, be increased, and either he will have to lay the first gun himself and cause the subalterns to look over the sights so as to fix the object in their minds,

[1] "Times," 18th September, 1890.
[2] "Times," 22nd September.
[3] "7th Letter on Cavalry."

or some sort of indicator may be used which all Nos. 1 can look over before laying their gun for the first time. Batteries will therefore not open fire in such a hurry as formerly, and very much will depend on the first shot being well laid. The most dangerous moment for artillery is when it comes into action in full view of an enemy already in position. The side which sees the other first will have gained a great advantage, as it can now often open fire without accurately disclosing its position. Therefore it is most probable that, except in urgent cases, guns will be brought up and unlimbered under cover, and then run up into position for the last 20 or 30 yards by hand. Guns peering over a crest are not likely to be noticed unless range-takers and battery commanders parade about on horseback in the open beforehand. Therefore their horses must be left under cover. The moral effect of the resulting suddenness in opening fire should be very great under such circumstances. These views are supported also by Captain von der Goltz[1] and by Captain Moch.[2]

If the ground permits of it the ranges at which fire will be opened will increase; for though it is to the interest of the assailant to get his artillery up to decisive range as soon as possible, yet the defender will prevent that, if he can, by opening fire immediately he sees the advancing enemy. The assailant, not seeing how far the enemy is away, will feel bound to take up the challenge till more definite knowledge of his position is obtained. This at least will be the case with the advanced guard artillery, though the reinforcing guns might at once advance to a closer range. The difficulty of regulating distant fire, with no puffs of smoke to guide the commanders of batteries, cannot but lead to considerable and increased expenditure of ammunition before the true range is found, in spite of all improvements in sights and range-finders. Commanding positions for guns will be sought after more than ever, in spite of the resulting plunging fire, for from such positions alone will it be possible to observe accurately the position of the enemy's guns, and, consequently, the relative burst of the shell. Batteries without such command may have observers stationed on trees or the tops of houses, where such exist; but at present balloons would appear to be too complicated and bulky for that purpose with a field army.

Smokeless powder may also enable guns to remain in action at closer intervals, since the laying of one gun is no longer impeded by the smoke of its neighbour. Hence a larger number may be brought into action in a given space.

Laying by means of pickets and clinometers from reverse slopes is sometimes advocated as a means of escaping loss. The disadvantage of smoke is here felt to a less extent; but for an assailant such a method can never succeed, for there would be great danger of firing into one's own advancing infantry as they approach the enemy—to say nothing of the inferior shooting. A very weak defensive force might, however, resort to it.

In general the influence of the formation of ground will be in-

[1] "Revue d'Artillerie," June, 1890.
[2] "Revue d'Artillerie," January, 1890.

creased, for folds of the ground, woods, hedgerows, &c., will alone have to be relied on for concealing movements. Should these not exist in an enemy's position, his reserves moving up either in attack or defence will be subject to cannonade more than ever. It therefore becomes an absolute necessity to silence the opposing guns before taking the offensive.

Shields for guns have been powerfully advocated as tending to diminish losses, but it would appear that they might offer a desirable target to an enemy, and it is only during the laying of the gun that the gunners would benefit by them. Besides, they offer no protection to limbers and teams.

Artillery v. *Infantry.*

Artillery may have opportunities of surprising infantry columns at long range in the future as in the past, and the fact of not seeing whence the shells come will add to the effect on the nerves of the infantry, and cause them to deploy sooner than might otherwise be the case. On the other hand artillery have more to fear from the fire of skirmishers in cramped country where they can creep up within range. The greater range of the infantry weapon and absence of smoke on both sides will make it easier for the skirmisher to pick off the gunners. Captain Moch[1] relates an incident at the battle of Sedan which has a bearing on this subject. A Bavarian skirmisher had established himself among the branches of a tree within easy range of some French infantry lining a wall near Balan. From this position he kept picking off the men at a particular part of the wall, and it was a considerable time before the smoke proceeding from the tree betrayed him. Similar feats will now be more easy; and if this was done against infantry, why not against artillery?

Machine-Guns.

The effect of smokeless powder on machine-guns is probably more distinctly to their advantage than it is to any of the other arms. The successful employment of these weapons depends mainly on their not being knocked to pieces or caused to retire by the enemy's guns in the earlier stages of the fight. Smokeless powder will render it next to impossible for artillery to distinguish their position, if well placed, and therefore they no longer offer such a target as they did in the Franco-German battles. That being so, they remain available for turning their whole attention to hostile infantry or to any artillery or cavalry which venture within effective range of them.

As regards the firing of the machine-guns themselves, it is well known that with black powder it is impossible for the firer to see over the sights after the first round or two. With smokeless powder that difficulty disappears, and continuous accurate fire can be kept up at all critical moments. The effect does not, as with artillery, depend on the accuracy of one shot, but on that of a quick succession of shots.

[1] "Revue d'Artillerie," p. 394, 1889.

Thus, with the old powder the machine-gun in action was seen without being able to see the enemy. Now the firer can see the enemy without being seen.

The Command of an Army in Battle.

Formerly two lines of smoke showed the Commander-in-chief and his subordinates the exact respective positions of the combatants. This will be the case no longer. The Commander of an army, or even of an army corps, must still further rely on the reports of others and see with their eyes. On the other hand, a better general view of the country will be obtainable, and the approach of large masses will not remain undiscovered. Austrian Officers state that the Crown Prince's troops gained Chlum, the key of the Königgratz position, unseen, through the air being thick with powder smoke. This is not likely to happen again. Perhaps, also, the smoke of the German guns and French infantry hid from the latter the strength of the Saxon turning movement at St. Privat.

Effect of Smokeless Powder and Magazine Rifles on Cavalry.

"Cavalry will suffer more than any other branch of the Service by the introduction of smokeless powder, for their best friend was always the smoke which veiled their attack and which always made difficulties for the infantry in finding the object aimed at,"[1] writes a German Officer on the subject. Let us examine how far his opinion may be accepted.

At Mars la Tour, the great modern battle in which cavalry played an important part, we find that every charge made against infantry or artillery was directed against their *front*. Bredow's was against the front of 12 guns and swept through them to fall on infantry and cavalry in rear. Doubtless the smoke of the guns assisted the ground in concealing the onset (for the cavalry were not seen till within 400 yards of the guns), and little loss was experienced in this first stage. It was during the retreat for more than a mile through a large part of the French Army that the great loss took place. Thus the disadvantage of attacking the front, whether of guns or infantry, is clear, and this disadvantage will, no doubt, be so much increased by the absence of smoke and the improvement in weapons, that it will require *very* favourable circumstances and formation of ground to allow any chance of success to such a charge.

It is to be remembered, however, that these same causes have necessitated much more open formations for infantry, which now fight practically in long thin lines. It is considered also that in open ground, such as is favourable for cavalry, the supports and reserves of infantry will have to deploy in like manner. That being so, their front is evidently very strong against cavalry attack, but their flanks become proportionately weaker, for there may exist no closed bodies

[1] Bieberstein "Colburn's U.S. Mag.," February, 1890, p. 399. (Translation.)

ready to bring fire to bear on a flank except those far in rear. The flanks of artillery are also weak in themselves and require protection from the other arms. It has always been the case that cavalry attack is most to be feared and has greatest chances of success from a *flank*. These chances are not, therefore, affected so much by the improvement in weapons, and such an attack can be supported by infantry or artillery fire to the last moment. When the cavalry has swept along the hostile line, the distance it has to retreat under fire is comparatively short, and very different from that which Bredow's cavalry had to traverse.

Such opportunities for flank attacks may not often occur, but as they promise great results in giving breathing time, when the infantry are overmatched, they will be sought after by enterprising cavalry leaders. No doubt if all battlefields were perfectly flat plains where every movement could be seen for miles, or consisted of impracticable country, the cavalry *rôle* would be limited to watching the flanks of the enemy and opposing enterprises by hostile cavalry. But it is seldom that places cannot be found where considerable bodies of cavalry may remain hidden and move for considerable distances unseen. When such are obtainable they give much more effective cover than smoke. Here, again, we find increased importance attached to the formation of the ground and the intelligent use of it.

As illustrating what may be done in war by what has happened in peace, at the German manœuvres[1] of 1879 a regiment of lancers surprised and charged four battalions who did not see them till within 200 yards of their flank. Scarcely a shot was fired before they were among the infantry. The decision given, with the approval of the Emperor and von Moltke, was that three battalions were placed *hors de combat*. The Colonel commanding the lancers had moved personally to a well-chosen spot, had been quietly observing the movements of the infantry, himself unseen up to the moment when he gave the signal to his regiment to charge.

The service of reconnaissance is, however, now of such importance and will harass cavalry to such an extent, that it is unlikely that large bodies of that arm will be used actually on the battlefield. Small bodies, say not larger than a regiment, will move faster, be more easily hidden, and not so readily thrown into confusion, and will, therefore, fulfil the duty of suprising an enemy better than large masses of horsemen such as appear to find favour in Germany at the present moment. Single horsemen may also be found most useful actually on the field of battle to discover movements of the enemy. As Prince Kraft[2] observes, such small objects as individual horsemen are unlikely to attract fire, such is the power of hostile fire to engross the attention of infantry and artillery in action.

As regards the dismounted action of cavalry, the magazine carbine will doubtless add considerably to the defensive power of the arm, in holding defiles, bridges, &c.

Against routed infantry, cavalry are likely to act as effectively as

[1] Article on "War," "Encyclopædia Britannica."
[2] "7th Letter on Cavalry."

ever, for then it matters little whether the former are armed with pitchforks or with magazine rifles, for they will be incapable of using them.

Reconnaissance.—It is perhaps in the duties of reconnaissance that cavalry (and infantry also when thus employed) will find the greatest change in comparison with the same under the old conditions. With the old powder, the first shot fired at a patrol gave warning of the exact position of an enemy. With smokeless powder this is no longer the case, and all that can be expected is that the path of the bullet may give roughly the direction of the firer and the sound some idea of the range. A cavalry patrol, stopped by rifle fire with the old powder, could on its return give some information of the enemy's position, but with the new their report must be more meagre, and their chances of having been surprised by an ambush of magazine fire greater. Hence reconnaissance must in future be more costly. The same holding good on both sides, it ought to be easier to cover one's own front and prevent the enemy's patrols penetrating the screen. The result of all this will be to enhance the value of good eyesight and aids to vision, such as field glasses. The troops which are clothed in the least brilliant uniform and equipped with the least shiny accoutrements will hold a great advantage over the other side, with cavalry as with infantry. Grey horses will be at a great disadvantage. It follows, that training selected men in peace time in the observation of distant objects and in sending reports will be as important to the cavalry as training in observation of fire is to the artillery. As one man can see as well as fifty, and can move more quickly and is much less likely to be seen, officers' patrols will become more common and more important in their results. It may sometimes be necessary to send all the officers of a squadron, except the Captain, on these duties. This will necessitate, on the other side, more frequent patrols between parallel columns to guard against the enterprise of these officers.

The general result will be that it is impossible for cavalry alone to reconnoitre an enemy in position, though sometimes the configuration of the ground may give intelligent officers a shrewd idea of his position. General Ferron's orders[1] to the 18th Army Corps, at the French Manœuvres this year, were that cavalry patrols must halt as soon as within the zone of effective fire, and infantry companies were to advance on the flanks and drive back the enemy's posts, officers being in rear with good field glasses. Thus we get the two extremes, officers' patrols and reconnaissances in force.

Outposts, as affected by Magazine Rifles and Smokeless Powder.

From what has been said above, it is evident that the precise position of the outpost line will be more difficult to make out. The sentry who gives the alarm by firing his rifle need not thereby betray his position, and, in spite of what has been said to the contrary, the noise of the report is quite sufficient to reach the picquet.

[1] "Army and Navy Gazette," July 26th, 1890.

This difficulty in getting information of the outpost line will make it all the more necessary to surprise sentries and picquets, for the results will be more valuable. *The flash of a rifle being seen at night, while invisible by day, may* cause attempts on the outposts by night to become more frequent. *All this means* harder and more harassing *work on outpost* duty, but the superior defensive power of the modern rifle ought to alleviate this by reducing the number of *men necessary* in the outpost line when in contact with an enemy. Thus, where 1,000 men per mile were formerly necessary, 600 or 700 may now suffice, as long as the line of observation is not thereby reduced.

Guerilla Warfare.—The facilities afforded for surprising patrols, &c., by means of improved weapons and ammunition, will add to the power of the guerilla in ambushing and harassing an enemy. It must be met on the other side by increased watchfulness and activity in reconnaissance.

Résumé.

The effects of smokeless powder on the minor tactics of the future may be briefly summed up as follows:—

Infantry.—1. Increased facilities for fire discipline and control.

2. Improved shooting individually, both in rapidity and accuracy.

3. Non-betrayal of presence of skirmishers in broken ground, of sentries on outpost duty, or of firing line of defence.

4. Increased facilities for commanders of units combining action with adjacent units.

On the other hand:—

5. Exposure of moving bodies, such as attacking lines, supports, and reserves.

6. Consequently deployment will take place further away from enemy.

7. And the strength of the defence against frontal attack over open ground will be increased, but not over cramped ground.

8. Greater importance of cover.

Morale probably gains in respect of men knowing what they are about, but loses by reason of their seeing comrades fall around them, especially on the defensive, and by not knowing where the bullets come from, more particularly on the offensive.

Artillery.—1. Improved shooting and fire discipline.

2. Increased rapidity of fire.

3. Slightly reduced weight of ammunition.

4. Greater possibility of masking batteries, and their position remaining undiscovered. Hence importance of cover.

5. Observations of fire easier, if large object in neighbourhood of enemy's guns be chosen to regulate fire by, and not guns themselves unless plainly seen. Otherwise observation of fire more difficult.

6. Tiers of fire possible.

7. Guns must unlimber out of sight when possible, and be run up into position by hand.

8. Advantage of first fire make long ranges probable at first.

9. Greater facilities for supporting an infantry attack from a distance.

10. A larger number of guns can be brought into action in a given space.

11. Approach of infantry masses to attack guns cannot be made unseen as at Königgratz.

But 12. Individual skirmishers thus approaching in cramped ground and picking off gunners will be difficult to detect.

13. Changes of position will be more open to view, and therefore more dangerous than formerly.

14. Since smokeless powder gives the best results when detonated, it becomes almost a necessity to introduce metal cartridge cases with the necessary detonating arrangements.

Machine-Guns.—1. Invisibility to enemy's artillery.

2. Possibility of keeping up continuous and accurate fire without stopping to relay the gun.

But 3. Changes of position open to view.

Cavalry.—In conjunction with magazine rifles the effect of smokeless powder on cavalry will be:—

1. Possibly fewer chances for charging other arms than before, since the front of infantry and artillery will generally be invulnerable.

2. Nevertheless chances for flank attacks will still occur.

3. These attacks will probably not be undertaken by larger bodies than a regiment.

4. Increased difficulty of reconnaissance and probable necessity for adding to the offensive fire power of cavalry.

5. Greater power of holding bridges and defiles when dismounted.

Common to all Arms.—1. Greater visibility in motion.

2. Increased invisibility at rest.

3. Increased importance of making use of ground as cover.

4. Probability of reconnaissance by night becoming more frequent.

5. Impossibility of retreating under cover of smoke and consequent increased loss to the vanquished.

6. Preliminary stages of fight will take a longer time, though once within decisive range the decision will be more quickly brought about.

7. Necessity for neutral tinted uniform and equipment.

Magazine Rifles.

Evil Results foretold.—The introduction of these weapons was not accomplished without a great deal of criticism and ominous prophecies on the part of not a few authorities. It was foretold that they would cause an immense waste of ammunition and an entire absence of fire control. These critics have not yet been proved wrong by actual war experience, but it is probable that careful thought, combined with experiments, will show us how to avoid the evils prophesied. No doubt a mob, or even badly-trained soldiers, armed with magazine

rifles, would do no better than if they had merely single-loaders, provided the same amount of ammunition were supplied in both cases, but fire discipline of the strictest kind ought to go a long way towards getting over the difficulties which lie in the way of developing the power of the new weapon. That due to smoke blinding the fire after the first round or two has already been got over, and the absence of smoke will also assist the commander in the general control of his unit. Without smokeless powder it is doubtful whether any great advantage would be reaped from the introduction of magazine rifles.

Nature of the Weapon.—The weapons of themselves do not appear to warrant any revolution in tactics. They simply mean giving to troops the power of firing for a time considerably more rapidly than with a single-loader. Colonel Löbell[1] says: "The rifle as a repeater offers to the soldier a constant and continuous readiness to fire, which is preserved by means of its careful and judicious application, and by a continual and timely filling up of the magazine. The soldier must bear in mind that his arm increases the necessity for a thorough fire discipline, and that the repeating arrangement is intended to heighten the actual effect of the fire, and not only to increase its rapidity." Superior range and flatter trajectory add to the increased power of the weapon, while smokeless powder makes the shooting more accurate, and the result is that troops will fight at greater distances and in less vulnerable formations than formerly. "Changes in arms usually produce modifications in tactics, but as a rule in the *tactical formations* only, and not in the principles of the combat as regards attack and defence."[2]

Chief Difficulty lies in Regulation of Fire.—As inferred above, it is in fire discipline that the chief difficulty with the magazine rifle will be experienced. The increase of power now placed in the hands of the soldier may be entirely wasted if not applied at the right moment and on the right object.

Means of Overcoming this Difficulty.—"When firing once begins men easily get out of hand unless restrained by an iron discipline," says Prince Kraft. "Fire discipline means decentralization of authority; no superior can properly control more than four to eight subordinates, so let this be recognized and carried out through everything, and let each superior be allowed the control of this limited number."[3] Foreign regulations now recognize as necessary such extreme decentralization. The Germans divide their zugs into groups of eight men under a non-commissioned officer for purposes of fire discipline, and this system is also followed by France and Austria. Against smoothbores control of fire and volley firing by battalions was the custom. With every improvement in weapons this unit of fire control becomes smaller; thus, with breechloaders in the War of 1870, it was attempted to control the fire of companies of 250 men almost direct from the Captain. The attempt signally failed, because that number

[1] "R.U.S.I. Journal," vol. xxxii, p. 841.
[2] "Changes in Military Matters during 1887," "R.U.S.I. Journal," vol. xxxii, p. 838.
[3] "Discipline," "R.U.S.I. Journal," vol. xxxiii, p. 305.

made too large a unit for the weapon against them. The German system of training of the day had not contemplated such decentralization as was really necessary for the efficient conduct of fire, and therefore in most cases the fire degenerated into simple independent firing. In the French Army apparently fire discipline was almost unknown at that time. Hence, as a result of the experiences of that war, the present Continental system of decentralization, extending down to groups of about eight men, has grown up. Such a number as this, besides being easy to control, will present but a small mark for an enemy. If this system be accepted let the training of men in peace time all tend in that direction. The confusion of the battlefield and the mixture of units is bound to take place again as it did in 1870. Our task is to make the confusion more apparent than real, and if the units be so small they can hang together longer.

The Decisive Range.—But what, after all, is the infantry fight? A German authority[1] tells us: "The infantry fight will resolve itself into a prolonged and costly struggle, necessitating bringing up the rear lines. Their *rôle* will be to feed the fighting line and replace the waste, thus becoming a mere source of supply. . . . . The absurd idea of attempting to decide the issue by attacking with masses of troops brought up from the rear in close formation must needs suffer considerable modification, 1st. Because they will have to be dissolved to feed the fighting line; 2nd. Because it will be quite impossible for the masses to traverse the fire zone."

The distance at which the "prolonged and costly struggle" will take place will doubtless vary according to the ground. On open ground, owing to the flatter trajectory and superior accuracy of the present rifle, it will probably be greater than in the days of single-loaders. A writer in the "Militär Wochenblatt,"[2] estimates it during the last wars at 200 to 300 metres. "In the wars of the future," he says, "the decisive fusillade will take place at 300 to 400 metres, or even more." General Ferron,[3] in his instructions to the 18th Army Corps, this year, tells his subordinates that, owing to magazine rifles and the absence of smoke, the object of the attack is to constitute a firing line at 700 to 400 metres superior to the enemy and then force him to quit by artillery and infantry fire combined.

It seems probable, judging by past experience of changes in weapons, that the above views are correct, and that over *open ground* the decisive magazine fusillade will take place somewhere from 300 to 700 yards from the enemy. When the ground allows a nearer approach, however, the combatants may get much closer. At Majuba,[4] the critical moment occurred when the Boers were within 30 or 40 yards of our line, and the formation of the ground would not have allowed that distance to be varied with either magazine rifles or muzzle-loaders.

[1] Major Keim, "Present State of Tactical Science," "R.U.S.I. Journal," No. 152, p. 548.
[2] 1st Article, No. 106.
[3] "Army and Navy Gazette," July 26th, 1890.
[4] "Carter's History of the Boer War."

The Attack.—The task for the attack is, then, to find out means by which this powerful line of fire can be brought up to the decisive distance with the least possible loss in men, morale, and fire discipline. The nations of the Continent have solved the question much in the same way as far as can be done without actual war, the solution being, by general consent, lines of men in extended order constituting the firing line, followed by supports and reserves whose duty it is to feed this line and urge it forward. Yet voices are occasionally raised against many details of this system, owing to the difficulty of controlling men in extended order, and of preventing straggling. Perhaps the most remarkable protest is the "Summer Night's Dream," a translation of which from the German appeared in the United Service Magazine.[1] The writer hopes to find a remedy for the fire discipline difficulty, and for the immense amount of straggling which took place in 1870, in "rejuvenated linear tactics, suitable for modern fighting and consisting of handy single ranks with no depth of formation." The real fighting unit is fixed at a quarter of a German company, or about fifty men, which must advance in single rank in line, the men keeping the touch when the ground allows of it, and firing volleys by word of command. By an iron discipline men are not allowed to take cover in ditches and other places from which it might be difficult to move them for a further advance. The cover allowed to the firing line appears to be only what can be obtained by lying down, which is done by word of command. This system bears a remarkable resemblance to the method of attack at present laid down for our Service in many particulars, and also to that of the French Army, as employed at this year's manœuvres.

Means for attaining the Main Object.—Keeping our main object in view, viz., the establishment of a powerful firing line at decisive distance from the enemy, let us consider how to get this firing line up to this position.

(1.) *Covering Fire.*—It is evident that the enemy must have his attention distracted, and must be kept from showing himself above his shelter trenches by *covering fire*, which must be kept up as long as possible. Here comes in the immense importance of the shape of the ground, which to favour the attack should enable such covering fire to be kept up till the arrival of the firing line at the decisive distance. Apart from artillery, it is probable that the increased range of modern rifles will enable effective covering fire to be made use of by infantry reserves, as is said to have been done by the Boers at Majuba.

(2.) *Rapid Advance.*—The fighting line should be exposed to the enemy's fire for as short a time as possible. Therefore it must move forward as quickly as is consistent with steadiness and with arriving at the desired distance without unduly fatiguing the men.

(3.) *Powerful Firing Line under Strict Control.*—The firing line should be as powerful as possible without crowding. As the author

[1] June, July, and August, 1890.

of the "Summer Night's Dream" conclusively proves, this is only to be done by placing men in one line, and therefore any system in which men are not closely connected appears to be founded on wrong principles. The old extended order was only suitable for skirmishers who were so far apart as not to interfere with each other's fire. "The skirmisher placed in a dense line has in reality no more freedom in choice of cover than the man in close order."[1] He cannot go forwards or backwards to seek cover without interfering with his neighbour's fire. "The best way of avoiding the effect of the enemy's fire is to lie down, and troops in close order can do this as easily as firing lines. Our company columns are skilled in the art of utilizing natural features of the ground to approach an enemy unseen."[2] Again as regards thin skirmishing lines: "I do not dispute the value of thin lines of skirmishers when no serious engagement is intended. . . . . But if you are going to commence your attack with so thin a firing line as to have 5 or 6 paces interval between files, your skirmishers will indeed have smaller losses, but your troops in close order (supports) greater losses. The enemy who opposes you with a dense firing line will have, with an equal front, twice or three times the number of rifles in action. Your reinforcements on their way up will be insufficiently protected by the firing line and will be annihilated. . . . . Fire discipline will be difficult from the outset."[3] After describing how he would have the units open ranks to pass obstacles in cramped ground, he goes on: "It is precisely in cramped country that you must need cohesion and dash since all the advantages are on the side of the determined attack. Nowhere is extended order, *when constantly maintained*, more unsuitable and dangerous than in such country." How true this was of the wood fighting in 1870.

It is self-evident that such comparatively close order will make fire discipline and control more easy, and therefore the fire will be more effective and its effect on the enemy greater. Consequently, fewer men will be lost, for the formation will lose least which can do most injury to an enemy; and troops in single rank keeping the touch really offer no better target than clouds of skirmishers. Finally, troops in such definite formations would be much more likely to march forward than those in extended order with all its attendant evils. This is sufficiently illustrated by the writer of the pamphlet above mentioned, when he describes[4] how, in a battle in 1870, his men, who were holding together and advancing, suddenly disappeared in every direction but that of the enemy, when ordered to extend by a superior officer.

The conclusion is therefore arrived at that the firing line, to be really powerful, effective, and under control, should be composed of a line of men, allowing a yard per man, the whole line to be split up into units each of which has its leader and second in command, this decentralization of authority extending down to groups of about eight men.

[1] "Summer Night's Dream," "U.S.M.," p. 213.
[2] *Ibid.*
[3] P. 214.
[4] P. 359.

It is most probable that Colonel Hallen aims at getting much nearer the enemy for the decisive combat, and in much larger units than will be possible with modern weapons, but the "Dream" itself must be taken more as mere special pleading on behalf of fire discipline. Firing must and will commence as soon as serious losses begin to be experienced, so long as the enemy's position can be made out.

After condemning the advance under heavy fire without returning it, Major Keim says:[1] "Why should a body of troops, weakened both physically and morally, be supposed to have better chances of getting up sooner and nearer to the enemy than another whose advance is carried out under considerably more favourable tactical and moral conditions? This theory might hold good against an enemy inferior both in shooting power and bravery."

It is well known that fire becomes less effective when hostile fire is suddenly opened on the firers. Once the attacking line begins to fire its prime object must be to see the enemy and not to seek cover in the folds of the ground, where this prevents effective fire. It is to be remembered, however, that halting to fire means a certain amount of delay and loss of *élan*, and each halt for that purpose should only last long enough to give men breathing time. It is stated that the repulse at Laing's Nek was partly due to mounted Officers hurrying on men on foot with more zeal than discretion, till the latter were completely blown; and we have the disaster of the 38th Brigade at Mars-la-Tour to remind us how useless men are when tired out. Those who have taken part in an attack at a field day over 3,000 yards of country know well how fatiguing it is to men engaged in it. The time for halting to fire will therefore be grasped by commanders of units when they see their men can go no further in good order, through losses, fatigue, &c. When once this takes place it is probable that some reinforcement by supports will be necessary, as "impulsive power" once lost is difficult to regain.

(4.) *Volley Firing.*—As regards the method of firing, it seems likely that volley firing could be carried out by units of fifty men or so to begin with, but we cannot hope for this to be continued to the later stages of the attack. The nearer the combatants approach, the greater the losses and the louder the din of battle. Under such exciting circumstances, the units under control for firing volleys can no longer be so large as fifty men, even after deducting losses, and therefore the volleys will presently become section volleys and then group magazine volleys, till at last, even with the best disciplined troops and a stubborn enemy, independent magazine fire will decide the contest. Many authorities think the days of volley firing are past, but we may "leave the question with the remark that the moral effect produced by a volley is too great for the attempt to use it ever to be willingly thrown away, but that it would be now rash to take for granted that on service the best troops can be depended on to deliver, during close fighting, accurate volleys, unless it be in small

[1] "Present State of Tactical Science," "R.U.S.I. Journal," No. 152, p. 546.

parties. The possibility of even the fire of groups is disputed by Von der Goltz. It is obvious that, if he is correct in this respect, all attempt at regulating fire in action is—

> 'An effort only and a noble aim
> Still to be sought for, never to be won.'"[1]

(5.) *Support of Firing Line.*—The further to secure the efficiency of the firing line, it must be well supported, and for this the supports and reserves must be (*a*) within supporting distance, (*b*) under cover or beyond the dangerous zone of fire aimed at the firing line. It is the difficulty of combining these two conditions which forms the chief obstacle to the attack with the present flat trajectories, and where the ground is open it is impossible for supports and reserves to be within good supporting distance without suffering very severe losses. This leads us to expect that it is only where the ground gives cover to these supporting bodies that the attack will be pushed forward seriously. In all cases, it follows that leaders of supporting bodies must have a large amount of latitude allowed them in the formations they assume and the distances they preserve from the firing line. That the above is recognized in our Service is evident from the following passage in the "Field Exercise" of 1889: "Since neither supports nor reserves can usually fire without danger to the firing line, they will adopt the formation which is most suitable to the ground, and which will enable the leaders to hold the men most thoroughly in hand, while allowing them to advance without confusion and reinforce quickly when required. . . . . Great latitude must be allowed to leaders of supports and reserves in choosing the best formations."

(6.) *Reinforcement of Firing Line.*—When the firing line loses its impetus through losses and other causes, it must be reinforced by the supports, while the battalion reserves approach and become in turn the supports. As regards the manner in which this reinforcement is carried out, three conditions must be fulfilled:—(*a*) The units must not become mixed, and thus destroy control; (*b*) only sufficient supports should come up to keep up the strength of the firing line to about one man per yard; (*c*) an impetus must be given by each reinforcement, so as to carry the firing line forward.

To fulfil (*a*), the reinforcing bodies must be in complete units and not be spread over the whole firing line. It is known by experience that the tendency of losses is to cause the remainder of the men to close in towards the centre of their units, so that the line does not become thinned equally throughout. Thus the intervals between the various units widen into gaps or disappear altogether, causing still larger gaps on their outer flanks, for it is to be expected that while some companies will diverge from the common line of attack one way, others will do so the other way. Thus opportunities will be afforded for pushing up companies, half companies, or sections, when necessary, into the gaps thus formed. Here, again, our "Field Exercise" follows

[1] Article on "War," "Encyclopædia Britannica."

this principle, and lays down the minimum reinforcing unit at a section. In the case of the mixing of units it is to be observed that the mixing of the companies of one battalion is much less harmful than the mixing of different battalions, for every soldier knows the Officers of the battalion by sight at least, and most of the non-commissioned officers, so that the men are much more likely to obey them than total strangers. As regards (*b*), it must happen that the number required to fill up the gaps will often be under or over estimated. The former error is easily rectified by more troops, and when the latter takes place, Colonel Hallen's plan, of teaching the overlapping men to fire in two ranks, seems the most natural remedy. In order to fulfil (*c*) and carry the whole line forward, the system described in the "Summer Night's Dream" seems, again, to be in accordance with common sense. By each reinforcing unit advancing *through* the gap and lying down to fire some 50 yards beyond, it is reasonable to suppose that the remainder of the line would be impelled to move up to or beyond them. Naturally the units nearest the gap must cease fire when the reinforcement passes through. Thus the further advance will resolve itself into alternate rushes, every rush being covered by fire from the units lying down. Prince Kraft says:[1] "When a part of the skirmishers has taken up its position near to the enemy and has opened fire, honour and comradeship compel all the other skirmishers to hurry up to them in order to share their danger shoulder to shoulder and to fight with them. The moment when the echelon which has gone first to the front opens its fire is the most favourable for all others to gain ground quickly, since the enemy will, at this moment, direct all his rifles at those skirmishers which have the first advanced."

The Final Stage.—As before stated, the final crisis of the fight will take place at any distance up to about 700 yards, according to the nature of the ground and the enemy. The result of the combat will depend on which side can bring the most rapid and deadly fire to bear on the other. Until the fire of one side or the other is got under no bayonet charge or further advance can possibly take place at such deadly range, for to advance across the open would give the advantage of fire to the enemy. The time necessary to get over even 200 yards would suffice for the other side to turn the tables unless his fire had been almost completely subdued.

Flank Counter-attacks.—During this period flank counter-attacks are much to be feared, and the magazine rifle increases their power just as the B.L. did as compared with the M.L. Prince Kraft says:[2] "It is quite true that pressure on a flank has now tenfold power," and relates how at St. Privat a line of nine French battalions which were annoying his guns and could not be driven back by frontal fire, retired at once when taken in flank by one single German company. How much more would this be the case with magazine rifles? Therefore especial care must be taken, by means of echelons of troops, to protect the exposed flanks of the attack.

[1] "12th Letter on Infantry."
[2] "6th Letter on Infantry."

Retreats under Fire.—Whichever side is driven back must suffer enormously in its retreat through the far-reaching power of the new arm, and this must more particularly be the case where the ground—as at Majuba—allows the combatants to approach close to each other before the fight is decided.

Normal Attack Formations.—As regards the exact drill of the attack, the latest German regulations lay down no normal formation, and any such is absolutely prohibited from being drawn up or practised. So far, however, they are the only nation which adopts this plan. On this subject Colonel Slade remarks:[1] "The German idea is that the young soldier, if once disciplined, ought not to be practised in a stereotyped form of attack which the varying circumstances of actual combat might not render suitable; but that if practised to act according to circumstances he is less likely to be hurried and confused when called upon suddenly to meet the enemy." It seems necessary, however, that the system of attack should be laid down sufficiently to ensure all regiments being able to work together without a hitch, and to guard against the danger of new and strange methods and words of command being introduced by too zealous Commanding Officers. The system should be sufficiently elastic to be adapted for all sorts of ground and the nature of the enemy, but the principles laid down must be the same throughout an army. It must be remembered that "most men become neither wiser nor more sagacious in the turmoil of battle—rather the reverse. The possibility, therefore, of correctly perceiving at the moment what measures and formations are required during an action should not be relied on."[2] On the whole it looks rather as if the Germans were trying a dangerous experiment. Most normal formations (*e.g.*, our own) contemplate the firing line advancing to within about 150 yards of the enemy before the crisis takes place. Though it is well to lay down in theory that it is necessary to get as near your enemy as possible, yet in practice it is very unlikely that the attack will be able to advance so far till the enemy's fire is completely subdued, except, perhaps, in cramped country, where the distance separating the combatants may even be much less.

The principles to be followed, therefore, in the infantry attack may be summed up as below:—

Résumé.—(1.) Covering fire to be made use of as much as possible.

(2.) The firing line should advance as quickly as possible, consistent with arriving at decisive range without undue fatigue, and therefore should not open fire till absolutely necessary.

(3.) The firing line should be as powerful as possible, consistent with each man being able to make full use of his rifle. The alignment should be kept in each unit.

(4.) Volley firing should be the rule.

(5.) Supports and reserves must avail themselves of all cover

[1] Lecture at Aldershot, 1889, p. 11.

[2] "Present State of Tactical Science," Major Keim, "R.U.S.I. Journal," No. 152, p. 544.

possible, consistent with due support of the firing line, which latter must consider fire efficiency before considerations of cover.

(6.) When necessary, the impetus to the firing line for a further advance must be given by supports, in complete units, advancing *beyond* the firing line.

(7.) The advance of one part of the line must be covered by fire from the other.

(8.) Flanks should be very carefully guarded.

For the carrying out of these principles under hot fire, every unit must have a 2nd and 3rd in command told off. As this may not be possible with groups of eight men, the remains of those groups which have lost their leaders must be trained to join neighbouring groups. The fire must be regulated by whistles, each leader and possible leader being provided with one. Straggling being the great evil, Colonel Hallen's suggestion for "battle police" seems likely to go some way towards remedying this. Their powers over individual stragglers would, however, have to be unlimited on the battlefield.

General Conclusions.—The conditions for the frontal attack by infantry have so much altered since the introduction of smokeless powder and magazine rifles, and altered for the most part to the advantage of the defence, that a serious frontal attack over open ground, against infantry in position, unless enormous superiority in artillery is obtained, will hardly be attempted in the future, except against indifferent troops. But the fact must not be forgotten that every increase of power to firearms also benefits the attacker, as regards covering fire, *once he has brought to bear fire superior to that of the enemy*, and the greater range allows greater concentration of this covering fire on the predetermined spot. This, combined with increased fire discipline, greater skill in making use of ground, and improved formations, may yet have unexpected successes in store for the determined attack.

The Defence.—The results of the introduction of magazine rifles to the defence appear to be simply to emphasize those produced by breechloaders, and further strengthen the front of infantry in position. Smokeless powder also enables full use to be made of the magazine, and gives it the power of inflicting a maximum of damage in a minimum of time. Thus it is a weapon of opportunity, and to get full value out of it magazine fire should be used at any range, so long as the target is proportionately large. But such firing should be conducted by rapid magazine volleys, and no independent fire should be allowed. Thus, magazine volleys might be used at supports and reserves of the attackers, which showed themselves in sufficiently dense formation to present a good target for the range, or at a battery of artillery coming into action up to 2,000 yards. But, naturally, the main use of the magazine will be at short ranges, when the crisis of the fight has arrived, or at cavalry or a retreating enemy. For proper control of fire under these circumstances, discipline must be, as it were, "instilled into the very limbs of the men," either for the attack or the defence.

Since open ground will generally be avoided by the assailant, the

defender must economize men by holding such portions of the position very lightly, and place the greater part of his force on the flanks and where the ground is broken or cramped and the view not extensive.

Field Fortification.

Shelter-trenches and gun-cover will be made more use of than ever in future, both by the attack and defence, in the former case to secure ground gained, or to make the front safe, so as to enable more troops being sent to turn a flank. On the defence, however, such cover will tend to disclose the position of the fighting line and guns, which might otherwise, through smokeless powder, escape notice. Therefore, the positions for these entrenchments will have to be judiciously chosen, and freshly turned earth must be covered with turf or branches of trees in order to mask its position.

Experiments have shown that the penetration of the new British rifle amounts to 36 inches of soft wood at 40 yards, but only about 2 feet of earth at 160 yards, while on meeting with stones in the earth the bullet sets up and goes no further. Foreign rifles, probably, give similar results, and, therefore, the best style of cover to construct is indicated by these facts. Artillery fire, in future, being mainly shrapnel, a great thickness of earthen parapet is not so necessary as is depth of cover to escape its searching effects. Head cover will also be sought after for the same reason. On the other hand, stockades may be said to have become worthless, compared with the amount of labour necessary in constructing them, unless made of such solid material as iron rails.

MACHINE-GUNS.

Introductory.—In considering the effect of these weapons on the tactics of the future, we find a great lack of instances of their successful and proper use in civilized warfare in the past, though the principle of this weapon is no longer a novelty in the military world. On this account it is difficult to illustrate our theories and arguments by quotations from records of occurrences in actual war. Hence a wide field is open for speculation and theory. Imagination must be largely brought into play, and a modern battlefield, in its great extent and confusion, must be pictured before the mind.

Nevertheless, some little use may be made of the experiences of the war of 1870–71, where mitrailleuses were extensively, though, generally speaking, most inefficiently, used on the side of the French. The same qualifying remark will, however, apply to the French artillery, which was lacking both in quality of matériel and in intelligent tactical handling to such an extent that there is scarcely an instance of its successful or satisfactory employment throughout the war.

If, then, the contrast between the value of bad and good artillery, on the French and German side respectively, is so striking, when

both sides had long been accustomed to the handling of that arm, why should not the contrast be equally striking between the value of the badly worked and inferior mitrailleuse, supplied to the troops only a few days before the war commenced, and the machine-gun, in its more perfect state of development, handled by men accustomed to its use, and trained in a system of tactics based on experience and common sense? The German artillery tactics of 1870 were evolved from the brains of men who had fought in the war of 1866, and had seen the comparative failure of the arm in that war; they made good use of this experience, and four years later the change in artillery tactics and its results were indeed marvellous. Why should not machine-guns and their tactics change in an equally remarkable manner?

Nature of the New Arm.—In talking of machine-guns, we assume that the weapons supplied to us can be depended on not to jamb at the critical moment, and that each weapon will be able to keep up an average fire of about 300 rounds per minute, for at least 10 minutes, and a lesser rate for a much longer period.

Machine-guns act by fire alone, and constitute a number of units of very mobile rifle fire (if well horsed). But, like artillery, they cannot use their fire when in motion, though, from the greater simplicity of their ammunition, these weapons can be brought into action more rapidly than artillery,[1] and being less bulky and lighter, they are more independent of circumstances. They can, therefore, act with great *suddenness*, but the nature of machine-gun fire adds great *intensity* to this suddenness, thus enabling the weapon to inflict a maximum of damage in a minimum of time. But as this fire proceeds from a very limited number of weapons, with less range than field-guns, it is obvious that artillery, by concentrating on each in turn, can silence them or cause their withdrawal when beyond effective range of machine-guns. In ranging, moreover, the latter stand at a great disadvantage as compared with artillery, for except on dry and sandy soil the limit of observation of fire is soon reached.

Comparing their fire with that of infantry, picked layers can be told off to each machine-gun, which, unlike a rifle, is fired from practically a fixed rest. Thus it is evident that greater control and accuracy of fire is to be expected from the machine-guns than from infantry, and consequently their effective range will be greater. Again, the space occupied on the march, or in line of battle, by machine-guns giving a certain volume of fire, is much less than that taken up by a body of infantry producing the same amount of fire. Yet infantry have a capability of acting independently over all sorts of ground on the offensive which can never be possessed by machine-guns.

Tactics as deduced from Experience.—Some idea of the future tactics of machine-guns may be gathered, as above stated, even from the

[1] The average time of the quickest battery at Okehampton in 1889, taken from coming into action to the 1st round fired, was 1 minute 24 seconds (Report by Colonel Murdoch).

experiences of 1870. The blunders of the French serve to bring into prominence only the more clearly the few occasions on which they did not commit errors. Yet, even with such mitrailleuses as they possessed, they produced 5 per cent. of the Prussian losses.[1]

We find in the early battles of that war (the only battles which can be profitably studied for our purpose) that the batteries of mitrailleuses were almost invariably pitted against the German artillery at considerable artillery ranges. At Weissembourg and Woerth especially, mitrailleuses are mentioned in such positions. They invariably drew the concentrated fire of the German guns on them, and were either destroyed or compelled to withdraw. This, then, is evidently *not* the way they should be employed in the future. But we have a few other instances of their employment. In the struggle about La Folie copse, at the battle of Gravelotte, we read:[2] "A mitrailleuse battery, in particular, on that high ground, commanded the north-west border of the copse, while another on the south corner of the latter swept the clearing between it and the Bois de Genivaux. . . . . General V. Blumenthal very speedily recognized the impracticability of an attack upon La Folie." The mitrailleuses here were evidently in the right place. They were secured from view of the German Artillery by the trees of the Bois de Genivaux.

Again, on the French left, the Prussian official account states:[3] "A mitrailleuse battery appears more especially to have been posted exactly in prolongation of the Gravelotte high road, and to have commanded it in the most effective manner." From this it is presumable that the mitrailleuse battery in question was to a great extent responsible for the disastrous ending of the attempt of the German cavalry and artillery to debouch from the road across the Mance ravine. Here, again, the mitrailleuses did their duty. The difference between their action in the above instances and at Woerth lies in the fact that at Gravelotte they were not pitted against artillery from the outset at long ranges, and when the German artillery did advance to St. Hubert, the mitrailleuses caught them coming into action at a range most favourable to the new weapon.

There is, however, a yet more striking example in the attack of the IXth German Corps artillery at the same battle. The official account of it is as follows:[4] "The artillery upon the spur south of the Bois de la Cusse was at this time in a very precarious position. A mitrailleuse battery had come into action at the most effective range, opposite the left flank of the Prussian line of guns. The 4th Heavy Battery in that neighbourhood, which had already sustained considerable loss from infantry fire, *was in a few minutes so damaged by the mitrailleuse fire* that several Officers, five gun commanders, and forty men were placed *hors de combat*, while nearly all the horses were killed or wounded." The further result of this was that four guns fell into the hands of the enemy. This, then, is a remarkable

[1] "Field Works," Colonel Brackenbury, p. 13.
[2] Part I, vol. ii, p. 29. Official account.
[3] *Ibid.*, p. 74. [4] *Ibid.*, p. 29.

instance of what the mitrailleuse could do when rightly handled This shows it up in its proper value, as the torpedo-boat of the battle-field. In a naval action a torpedo-boat does not foolishly expose itself alone to the fire of a battle-ship. It is when the attention of the battle-ship is already engaged with another more equal opponent (or under cover of darkness) that the torpedo-boat finds its chance. The case is somewhat similar with machine-guns. When the attention of the enemy's artillery is already engaged in the heat of action, they may seek their opportunity, assisted by the undulations of the ground, which may hide them till they open fire. We have Prince Kraft's opinion,[1] that small bodies of cavalry may approach engaged infantry unnoticed, and he gives several instances of the excitement which absorbs the attention of troops engaged with an enemy. Smokeless powder will doubtless still further aid the machine-guns in remaining unobserved, even after they open fire. Why should they not approach in the manner anticipated for cavalry, and come into action against engaged infantry or artillery whose flanks are insufficiently protected?

From the above considerations, we gather that machine-guns with an army on the defensive will act in the following manner in the battles of the future:—

Tactics on the Defensive.—(1.) They will be stationed to sweep defiles, roads, command the debouches of woods and defiles, and flank the *points d'appui* of the main line, thus forming the *caponiers of the defence*, as it were. When exposed to artillery at considerable ranges they will not draw that fire on themselves by firing at very long machine-gun ranges, but will remain without attracting notice till the approach of the enemy's infantry.

(2.) There will be well-horsed machine-guns ready to dash out, in conjunction with cavalry, and take advantage of such an opportunity as was afforded by the IXth Corps artillery at the battle of Gravelotte.

To these two, based on the experience of the Franco-German War, a third might be added which has no experience to back it up, and is therefore pure theory.

(3.) A reserve of well-horsed machine-guns, possibly the same as those mentioned in (2), might be held available for galloping off to any point in the defence which is hardly pressed. Such timely support might save the post till the arrival of the slower moving infantry reserves, and on the danger being dissipated, the machine-guns might be withdrawn, and held ready to act in a similar way in another part of the field. In holding such a position as that of the Lisaine, it seems likely that machine-guns might be so used. At St. Privat also, though the French Guard arrived too late to restore the battle, mitrailleuses might have arrived in time if handled with boldness.

Examples of the employment of machine-guns by an attacking army we have none. But it seems probable that their action will be somewhat as follows:—

[1] "7th Letter on Cavalry."

Tactics on the Offensive.—(1.) They will economize infantry by securing the front, in conjunction with artillery, against counter-attack, thus enabling more troops to be employed in turning movements.

(2.) They will assist artillery in covering the advance of the infantry to the attack, thus rendering long-range covering fire by infantry reserves less necessary, for machine-gun fire is the truest long-range infantry fire.

(3.) They will advance into the captured position at the heels of the attackers, and by their steady and controlled fire will be invaluable for firing on the retreating defenders or for beating off a counter-attack by his reserves. At such stages of the battle, the range being short, their fire would be most deadly, and quickness in coming into action being a great desideratum, they ought to have the advantage of artillery in this respect.

In Close Country.—The discussion, thus far, has had reference merely to the use of machine-guns in fairly open country. It is now desirable to inquire into their relative action in a close country like England, where hedgerows and fences of every description prevent any important movement of mounted troops, except by roads and lanes; where woods and trees in the hedgerows obstruct the view and make long-range firing very difficult, except where a great command over the country exists. Any soldier who has seen the great open rolling slopes on most Continental battlefields, where unrestricted view can be obtained to long artillery ranges, and who then mentally compares those countries with what we usually see in England, cannot but come to the conclusion that England is essentially an *infantry* country. Field days at Aldershot naturally do not bring this home to us, for they take place on ground specially chosen for all arms. In fact, owing to economical considerations, it is hardly possible to fight mimic battles over enclosed land and realize properly what it means. Perhaps a War Game, fought over such country, may assist us to a certain extent in appreciating its difficulties. It shows us how hard it is to make proper use of cavalry, except as mere scouts and stop-gaps, and how difficult it is to get artillery into any position where they can see beyond infantry range sufficiently well to fire with effect. No doubt many suitable open spaces and commanding positions do occur about the Downs in the south, and the moors in the north, but, taking the country as a whole, it appears that—

(*a.*) Cavalry will be largely used to fight dismounted.

(*b.*) Artillery will not often find extensive positions from which proper use can be made of its long range, and even when they are obtained the fences will provide cover for an enemy.

(*c.*) When guns are once in position it will be difficult for them either to advance to support an attack or to retire—column of route being the only possible formation in motion. Consequently, the roads would soon become blocked with a mass of guns and infantry. Therefore, as a rule, the greater part of the guns would have to remain in one position throughout an action.

(*d.*) It would be very risky to send on artillery in advance of the infantry to commence the fight, unless the proposed artillery positions were previously seized and secured from sudden attacks. This might be done by mounted infantry or dismounted cavalry, with some machine-guns to command the avenues of approach leading from the enemy.

Similar conditions of country might, therefore, affect the tactics of machine-guns as follows:—

(*a.*) In consequence of the limited view of the artillery the machine-guns would not be so liable to be destroyed by the enemy's guns at long ranges nor captured by cavalry.

(*b.*) Owing to the difficulty which guns would have in supporting an attack, the machine-guns on the defensive would have little to fear from them in the close attack.

(*c.*) The characteristics of close country being that every road or lane constitutes a defile, except for extended infantry, great opportunities for the use of machine-guns on the defensive will present themselves.

(*d.*) Just as artillery and cavalry are prevented from making full use of their mobility in close country, so also machine-guns will find it difficult to get about, except by road. Hence they would, for the most part, only be able to assist in the attack by following up on the roads the advantages gained by the infantry in the fields, thus securing each bit of ground gained. Where, however, the enemy's position is a commanding one, they can assist the artillery in covering the advance of attacking infantry by their fire.

(*e.*) From the above it follows that, in close country, machine-guns need not be equipped for moving very rapidly, except those which are attached to the cavalry.

Power of Surprise by Machine-gun.—It is evident that one great characteristic of the machine-gun is the power it has for getting the very utmost value out of a *surprise* of the enemy. The introduction of this weapon may be expected, therefore, to affect the tactics of the other arms chiefly in causing them to guard against surprise with increased vigilance. Cavalry is an arm which will naturally be on the look-out for such surprises, and, therefore, the presence or absence of hostile machine-guns will be ascertained by them to the best of their power. Should bodies of cavalry come within range of these weapons, without being aware of their presence, the penalty they will pay is likely to make them more careful in future. The same may be said of closed bodies of infantry, and, even when deployed, the facilities machine-guns afford for rapid moves off to a flank, to enfilade a line, either attacking or defending, will cause flanks to be guarded with especial care. Prince Kraft's[1] instances of the preoccupied state of hotly engaged infantry and artillery teach us that such strokes by machine-guns are to be expected on the battlefields of the future. It is, however, the artillery which can do most harm to the machine-gun, and which, in turn, has most to fear from that weapon.

[1] "7th Letter on Cavalry."

Cavalry can bolt or charge, infantry can deploy or get under cover, on the arrival of a sudden shower of bullets, but with artillery it is different. Caught on the march, one horse shot in a team means keeping, perhaps, a large number of guns, men, and horses under deadly and concentrated fire for some minutes. If surprised in action from a flank, or in coming into action from close range in front (as at Gravelotte), it means a large loss in men and horses, and possibly also of guns, if the machine-gun attack is supported by other arms. Guns cannot charge, and it is against the principles of artillery to retire, even if sufficient horses were left to enable it to do so. Therefore, the guns must be brought to bear as quickly as possible on the unexpected and possibly unseen foe. By the time effective fire is attained, the greater part of the personnel of the batteries may be struck down. Hence, the introduction of the machine-gun may necessitate the addition of trained scouts to each battery or field artillery division, to look after their flanks in action, while on the march it will more than ever be advisable to have some infantry in front of the guns. Before coming into action the position chosen should be taken and secured in advance by mounted troops with machine-guns, both of which may give place to infantry when it comes up.

Machine-guns acting with Mounted Troops.—It is obvious, and has indeed been recognized in our Service, that machine-guns afford a welcome addition to the fire power of cavalry. In the future, we may see bodies of mounted troops consisting of cavalry, horse artillery, machine-guns, and mounted infantry acting the part of the delaying force with success. Had the French at Sedan possessed such a force and had it been sent to St. Menges when news of the German advance on that side first arrived, the mouth of the Falisette defile might have been held long enough to enable the French infantry from Floing to come up; at any rate, the bold advance of the German artillery from this defile might have had quite a different result. Had Benedek possessed such a force at Königgratz, it might have given him the means of checking the Crown Prince's advance sufficiently long to enable him to deal effectively with Prince Frederick Charles' army. Numberless similar instances of the possible employment of such a force might be given, either as retaining forces or for making raids for the purpose of seizing important strategical points.

In the Cavalry Combat.—It will now be necessary to discuss what assistance these weapons may give to cavalry and horse artillery in the cavalry combat. It is evident that their rapid and intense fire will find a very suitable target in masses of cavalry, and, being essentially a weapon of opportunity, they would appear to be very deadly against that rapidly moving arm. They have no fuzes to trouble about, and the ease with which the direction of fire can be altered by their traversing gear, while actually firing, makes it possible for them to follow with readiness any lateral movements of the hostile cavalry; the ranges in such combats would usually be suitable to machine-guns, and the extra height of the mounted man makes errors in range of less consequence. Yet they cannot displace horse artillery, for the latter arm is necessary, not only to keep in

check the enemy's guns, which might otherwise keep both cavalry and machine-guns at a distance, but also to shell villages or slight defences which a bullet cannot penetrate. Were there no horse artillery, a whole cavalry division might be effectively stopped by a few men in a building commanding a bridge or other defile. It is the *combined* action of the horse artillery and machine-guns which must be sought for in the cavalry combat; the longer-ranging weapon distracting the attention of the enemy, and his artillery, while the other manœuvres round in co-operation with the cavalry. Then, masked by their cavalry, machine-guns might approach within effective range of that of the enemy, and coming into action perhaps unobserved, while their cavalry clear their front, a few hundred rounds might be poured into the hostile mass in a very short space of time, and the moment seized by the cavalry to take advantage of the confusion in the hostile ranks and charge.

The possibility of manœuvres of this kind will add to the duties of horse artillery, as it will now have to attempt to destroy machine-guns of the enemy before they arrive within range, and the resulting contest opens a large field for speculation in the future.

Use with Outposts.—On the few occasions in which artillery are sent on outpost duty, the guns are usually employed to command bridges or defiles which hostile troops must pass before making an attack. Within certain ranges, machine-guns would evidently be more suitable for the purpose, and the continuous stream of bullets would forbid the passage to the enemy till artillery were brought to bear, and the machine-guns pounded at long ranges. Thus the object of gaining time for the army they protected would be fulfilled.

For the defence of such places, or even of open country, against night attack, the machine-gun possesses an attribute which makes it particularly valuable, viz., that it can be laid by daylight on the desired spot and at the desired range, and clamped in that position so that the fire loses nothing in accuracy through being delivered in darkness.

Chief Drawbacks to their Use.—It will have appeared from what has preceded that the two great drawbacks which machine-guns suffer from are—(1) being seen, and therefore silenced at long range by artillery; (2) the difficulty of ranging. The first of these is evidently considerably modified by the use of smokeless powder, and another recent development of science—the range-finder—will, it is expected, largely reduce the second. Range-finders may now be considered to have passed the experimental stage, and to have really become a factor in warfare to be reckoned on, more especially for machine-guns.

Conclusion.—In conclusion, we submit that though machine-guns seem destined to play a great part in future wars, yet they will not abate by one jot the importance of artillery. The *raison d'être* of artillery is to silence that of the enemy, and then prepare the way for the infantry attack by beating down and demoralizing that arm of the defenders, which, owing to magazine rifles, is now more impos-

sible than ever to approach, if intact. If, therefore, the artillery is not strong enough to silence the opposing artillery, either the attack will fail or it cannot be attempted, and the offensive will fall to the enemy. It is therefore absolutely necessary that the artillery be not reduced by a single gun, so that machine-guns may step in.

Quick-Firing Guns.

Definition.—By quick-firing guns are understood those machine-guns of which the calibre is greater than that laid down by the Geneva Convention as the limit for explosive projectiles, *i.e.*, those projecting shells of about 1 lb. weight and upwards.

Such weapons are mounted on non-recoil carriages, and when the calibre of the gun is so great as to cause its field-carriage to recoil, it must be relaid for every shot, and becomes practically a field artillery weapon and a single-loader. Mr. Nordenfelt says[1] that the heaviest quick-firing gun he can make, of which the recoil is absorbed by arrangements in the field-carriage, is a 7·7-pr. There is thus a considerable difference in the power of its shell and that of our 12-pr.

Arguments for and against their Introduction.—To put the question of the introduction of these weapons into a field army, as artillery, in as simple a manner as possible, the arguments on both sides are given below, so that the value of both may be compared:—

Arguments for their Introduction.

(*a.*) The fact of having non-recoil carriages, metal cartridges, and percussion locks, produces greatly augmented rapidity of fire compared with field guns.

(*b.*) The enormous destructive and moral effects of the rapid projection of a number of shells on an enemy. The fire, it is said, can be continued for a number of rounds without relaying, and yet have sufficient accuracy.

(*c.*) Greater lightness of the gun as compared with the field gun.

Arguments against their Introduction.

A. Fire effect depends on weight of shell as well as rapidity of fire, and it is argued that one good 12-pr. shrapnel will have more effect than many of much smaller calibre and bullet capacity.

B. Though theoretically it is unnecessary to lay the quick-firer for every round, yet, practically, this is not true. Mr. Nordenfelt[2] acknowledges that his 7·7-pr. has to be laid for every round at long ranges, and even at very short ranges, the accuracy is not great when not relaid.

C. The weight of the carriage and non-recoil arrangements have to be so great that the total weight of gun and carriage is brought up to that of the 12-pr. and carriage.

[1] "Quick-firing Guns in the Field," "R.U.S.I. Journal," vol. xxxii.
[2] *Ibid.*, p. 23.

This is proved in Captain Maudry's work.[1]

(*d.*) Economy in men required to work the gun.

D. The quick-firer would really require as many men as the field gun, for the duties to be performed are very similar, and losses have to be provided against.

(*e.*) Capability, owing to non-recoil, of being fired from much steeper reverse slopes than field guns.

The number of men at the gun with the 12-pr. is only four, inclusive of the gunner bringing ammunition from the men at the limber, while Mr. Nordenfelt reckons the same number as required at his gun.

Thus all the arguments in favour of the quick-firer except (*e*) are answered on the other side.

In addition, there are the following objections to them:—

E. Against earthworks or buildings the 12-pr. common shell should have decidedly the best of it.

F. Waste of ammunition likely to be caused by the quick-firer. This, however, might be remedied by fire discipline.

G. Difficulty of observing bursts of such small shell.

H. If introduced in addition to the 12-pr. it means complication of ammunition.

I. Inferiority of quick-firer at long ranges as compared with a field gun.

K. The time taken to set fuzes prevents any very great rapidity of of fire being attained.

Conclusions.—Thus the weight of argument appears to be against the quick-firer for a field army. A firearm in the field must project either the smallest projectile capable of killing a man (like rifles and machine-guns), or its projectile must be as large and powerful as possible, consistent with mobility, in order to produce the greatest possible effect, be it man-killing or battering.

Yet the principle of quick-firing guns must not be thrown aside. Rapidity of fire at critical moments is of vital importance if accurate, and thirty shells bursting over a given area occupied by troops, in five minutes, would produce an infinitely greater effect than the same number spread over twenty minutes. The *destructive* effect produced varies directly as the quantity of shell showered on the area in question, but the *moral* effect may be said to vary inversely as the length of time during which these shells arrive. The reason for this is simply that the men have not time to recover from the shock produced on their nerves by seeing one effective shell, before another, equally destructive in its effects, arrives on the scene; and this increases as it goes on. Therefore we must seek to augment the rapidity with which field-guns can be fired. Theoretically, no more

[1] "Quick-firing Guns for Land Service," "R.A.I. Journal," 1889.

ammunition will be required, as a greater effect will be produced in a shorter time by a given number of rounds. Practically, however, some increase of ammunition will be necessary, but this question is discussed elsewhere.

Steps have been taken in the direction of increased rapidity of fire by the introduction of arrangements for checking the recoil of field-guns. By this means, also, guns will be able to come into action on steeper reverse slopes than at present. Shells will, in future, be carried into action ready-fuzed, and fuzes will be capable of more rapid setting. It is probable also, that shell and cartridge may be fitted together in brass cases and fired by percussion locks, but this means an increase of weight, for the cartridge cases necessary for this would weigh at least 2 lbs. each for the 12-pr. An improved system for supplying ammunition from the limbers and wagons will also tend towards the desired rapidity of fire at critical moments.

By means such as the above, once the opposing artillery get within decisive range, they will settle which is to be the victor in a shorter space of time, and the victors will be able to pay increased attention —now so necessary—to the opposing infantry.

Horse Artillery.—The question of supplying quick-firing guns to the horse artillery batteries with the cavalry division, is not open to quite such grave objections as in the case of field batteries. Horse artillery frequently have to fire a few shells very rapidly and then limber up. They have seldom to remain in action for very long, unless placed in line of battle with other guns, but probably in this case, as at Mars-la-Tour, they would be better employed with cavalry on the flanks. At the same time, guns with the cavalry division must have sufficient weight of shell to dislodge an enemy from a house hastily prepared for defence. Therefore, if a suitable non-recoil carriage can be constructed for a 7- or 8-pr., of sufficient lightness to be used as horse artillery, it is probable that the balance of advantage would lie in the substitution of such a weapon for the present 12-pr., though some disadvantage might occasionally be suffered from an enemy with a heavier projectile.

The other alternative is to substitute a lighter 12-pr. gun with 1,500 feet muzzle-velocity The carriage required for such a gun would be much lighter than the present one, and the recoil not so great. It appears a question of weight behind the team, and non-recoil *versus* calibre; but if a light 12-pr. and carriage can be constructed so that this total weight does not exceed 5½ cwt. per horse with limber packed and with small recoil, then we prefer such an armament to a reduction in calibre, provided that the ammunition be made up in a similar way to that of the quick-firing gun.

Higher Tactics.

The Offensive.—"Theory overlooks the fact that under normal conditions it is uncommonly difficult even to *initiate* an infantry attack, quite irrespective of carrying it through, as long as any important portion of the enemy's artillery remains effective. . . . Considering

the extraordinary precision of modern artillery fire as compared with that in past wars, an infantry attack which has to work its way through artillery fire in its principal phases has no prospect of success."[1] Even in the war of 1870, Major Keim says, this was practically the case, and shrapnel fire was unknown then. It is evident, therefore, that artillery has further developed its importance, and that side on which the artillery (in ordinary country) proves the stronger will alone be able to take the offensive. A great development of *covering fire* is to be sought for and expected, once the artillery duel is over, in order to enable the infantry to move forward to the attack with the least possible loss, and this covering fire will be mainly furnished by artillery and machine-guns, and probably by infantry reserves, when they can do so from a flank. Artillery and machine-guns must, however, fire over the heads of their infantry, and those troops which cannot stand this are useless for the attack.

Over open ground, the above-quoted authority remarks: "Neither the action of successive lines nor the mechanical pressure of reserves will ever suffice, in the battle of the future, to secure success for the assailant. Reserves must act independently to threaten the flank or line of retreat, or where they would have a strategic effect on the whole situation."[2] Such were the tactics carried out at the late French manœuvres at Cambrai,[3] and in the American Civil War, by Sherman against Johnston in Georgia. The characteristic of these tactics is the wide turning movement, and by this means the strength of the frontal defence can best be made use of by the offensive army. A smaller force than formerly can now be left to hold the front, and the co-operation of the divided forces can be better secured in these days of field telegraphs than used to be the case.

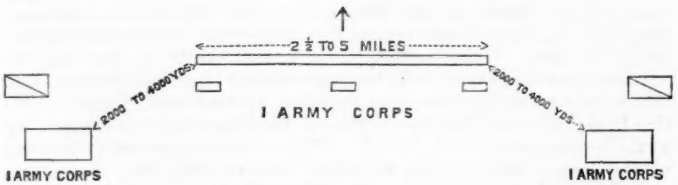
The Defensive.—Just as continuous lines in permanent fortification have given way to detached forts, with the improvement in weapons, so, in tactical battles of the future, defensible localities at intervals may take the place of continuous lines of defence, the intervals being left to artillery. Thus the defensive line will stretch so far that the enveloping attack system will become a matter of great difficulty. But this cannot go on for ever, and therefore certain weak points of the line being detected, Napoleon's plan of breaking in at the centre may again be illustrated in the future. This is the more probable because of the longer distance the defenders' reserves may have to march, and experience does not tell us that the hardest pressed point is easily recognized and reinforced.

Lines of Battle. The Attack.—Von der Goltz draws the following conclusions on this subject, at a time when magazine rifles, though contemplated, were not introduced: "Whilst up to this time it has been customary for five or six army corps to occupy the enemy in front, whilst another corps threw itself upon his flank and proved sufficient for the purpose, this proportion will perhaps be reversed in future." Without going so far as this, it seems likely that in an

[1] Major Keim, "R.U.S.I. Journal," No. 152, p. 544.
[2] *Ibid.*, p. 549.
[3] "Times," September 18th, 1890.

army of, say, three army corps, one of them might, on favourable ground, occupy the entire front, while the remaining two—masked by cavalry—attacked the enemy's flank or flanks, one or both, according to the tactical and strategical necessities of the situation. The cavalry veil covering the strategical advance will have its counterpart on the battlefield in the preliminary stages, and bodies of cavalry and infantry with machine-guns will spread out and occupy defensive positions over the whole front, once the enemy is ascertained to be in force too great for the advance-guard to sweep away. Under cover of this veil, the troops for the attack will be concentrated in the necessary directions, and the enemy must be fallen on both front and flanks simultaneously, though not necessarily in equal force in both directions.

The Defence.—As regards the defence of a position, the distribution of troops cannot but be much changed. On favourable ground, the front will be capable of being held by smaller numbers, and will leave larger reserves available to cover the flanks. This will be done, probably, by means of large detached bodies at distances varying from 2,000 to 4,000 yards on the right and left rear of the main line, connected, if necessary, by telegraph with headquarters. These detached bodies should be ready to fall, by order of the Commander-in-Chief, on any force making a flank attack on the main line, just as, at St. Privat, a similar detached force might have fallen on the Guards and Saxons when brought to a temporary standstill. Whether these detached bodies will be discovered by the attackers in time will depend largely on the relative strength and handling of the opposing cavalry, which arm will, on the flanks of the battlefield, have thus most important work to do. The defensive line of battle of three army corps may, therefore, be somewhat as represented below.



The same principles might be followed if divisions or smaller bodies were substituted for army corps.

Salient positions which can be enveloped, like Sedan, will be more difficult to hold than ever, as the concentration of fire due to increased range has become easier to bring about, and its effects are greater.

Some development in the tactics of the defence may also be expected in the direction of *false positions*. That is to say, a false position may be taken up by a certain proportion of the army—the ground being suitable—while the main position is within effective range of it in

rear. The object of the front position would be to cause the attacker to make his dispositions for and commit himself to attacking it as though it were the real line of defence, and the aim of the defender would be to retire from it after sufficient resistance, so as to cause the attacking troops, both frontal and outflanking, to become massed together in fancied success and considerable confusion within effective range of the main defensive line. The defender would then be in a position to make the most of this state of things, and probably take the offensive in his turn. Such were the tactics of Baker Pasha at Tashkessen, and they succeeded to perfection, though his inferiority of force prevented his resuming the offensive.

Retreats and Pursuits.—The defeated army, if driven off the field before nightfall, will probably, owing to the far-reaching effect of modern fire, be routed, and its only chance of safety will be under cover of the darkness, provided its resistance be stubborn enough to cause it to use up all reserves. In close country, however, a few determined men could stop the pursuit for a time by holding roads in positions whence they cannot well be ousted by artillery fire. In open country, their flanks being exposed, much more organized resistance than this will be necessary to check the pursuit, and comparatively fresh troops must be available to act as an efficient rearguard. The present decentralized fighting formation of troops does not admit of men, once beaten, being rallied to the same extent as was formerly the case, more especially as units are now so liable to become mixed.

Night Operations.—The necessity for making preparations for attack unknown to an enemy will often cause these preparations to be carried out by means of night marches, so that all may be ready for the onslaught at dawn. Attacks on a large scale made during the night, in order to gain immunity from the enemy's fire, are scarcely likely to be attempted, as the confusion caused among the attackers themselves would be such as no staff arrangements could prevent, and at night men are very liable to panic. Night attacks may, however, be made on favourable ground and against a careless enemy by small bodies when no combination marches are necessary, but *light* nights must be chosen both for this and for night marches, for it is then much easier to see friends and thus avoid confusion, while at the same time the foe is out of range of vision. Nights when clouds obscure the moon would probably be best, for there will be no reflection from glittering arms, and at the same time it will be dark enough to prevent an enemy seeing over the sights of his gun or rifle. Those who have done any night shooting well know how impossible it is to hit any large object, even twenty yards away, without white paper or luminous paint on the foresight. Open ground, over which it would be impossible to advance in face of an enemy by day, may be occupied by night and trenches dug to secure it, much after the fashion of opening the first parallel at a siege.

Influence of Ground.—It is probable that the nature of the terrain will have a largely increased influence in the future. Steep slopes, so long as they are not steep enough to form a serious obstacle to the

attack, will probably be a source of weakness to the defence, more especially if the attackers have good artillery positions within effective range. The crest defines exactly the line of defence, and such slopes afford the best opportunities for developing the covering fire of the assailant.

Broken ground in front of a position will be more a source of weakness than ever, for improved methods of fire discipline and control, and increased training of men for working over such ground will enable the attacker to make more and better use of it than formerly, when men untrained in such warfare soon became a disorganized mass.

Folds of the ground and woods, &c., are to be sought after by both sides and by all arms, to hide supports, reserves, artillery-wagons, and limbers, and bodies of cavalry, all of which have no longer any smoke to hide them from view. Such undulations not only give shelter from fire as before, but at close ranges the trajectory of modern weapons is so flat that the ground is actually less thoroughly searched than in the past.

Village fighting is not likely to be affected in any appreciable degree by the improvement in rifles.

The correct use of ground is therefore a most important part of the soldier's training. Just as, at Jena, the Prussians, trained after the method of Frederick the Great to fight only in the open, were beaten by the French, accustomed to adapt themselves to any ground, so in the future, the troops who can make the best use of the ground will have gone a long way towards securing the victory.

Thus, conditions of terrain will have an augmented effect on the battle of the future, and while a strong position will be more difficult, a weak one may become more easy to take.

Rear-Guards and Advance-Guards.—It has been seen that the difficulty of determining the strength and position of an enemy is now greater than formerly, and this ought to make rear-guard actions more easy to carry out. The enemy, unable to discover the strength and position of the rear-guard, will be more cautious, and he will know that ambushes for the rash are more easy to bring about. On the other hand, an advance-guard taking the offensive may frequently get involved in more serious fights than were bargained for. The risk, however, must be run up to a certain point and must be treated in the light of a reconnaissance in force in relation to the main army. This duty, however, does not necessitate advance-guards consisting of one-third of the whole force as in 1870. Such can only commit the army to premature battle. "If an advance-guard is large enough to gain time to the marching body to form up on suitable ground before attacked, it possesses all the strength necessary."[1] The distance between the advance-guard and the head of the main body seems likely to increase rather than diminish, since, on meeting an enemy, more time is given to the Commander to concentrate the troops of the main body in any desired direction before arriving on the battle-field.

[1] Article on "War," "Encyclopædia Britannica."

Retaining Forces.—Perhaps one of the most striking features in tactics with modern firearms is the increased power of resistance given to inferior numbers when opposed to large forces. Baker could never have held the heights of Tashkessen with 2,700 men against 30,000 in the old muzzle-loading days. Breech-loaders gave him the power to do so, and the latest improvements in weapons will still further increase this power. This would appear to make alternate blows at divided forces, after the fashion of the great Napoleon, still more possible in the future than in the past, the retaining force now having in a still greater degree the power to carry out its functions. On the other hand, however, the same argument tells us that the beating of the enemy's other army by the main forces may take a longer time. The truth, therefore, appears to be that where a retaining force is necessary, the one counteracts the other, and places the conditions much as they were. But where distance alone is relied on to prevent the two allied armies from combining, that distance will now have to be greater in order to give time to the concentrated opponent to carry out his object.

Crossing Rivers.—Owing to the longer range and concentrative power of modern weapons, this operation may be carried out under more favourable conditions than formerly. The ground being favourable, the whole neighbourhood of the intended crossing can be swept by fire till the landing is effected. The same holds good for a landing on a hostile shore of the sea. On the other hand, however, the defender by retiring out of range of the ships or forces on the opposite shore of a broad river, can bring a wider and more effective circle of fire to bear on the first party which lands. The tendency, therefore, appears to be towards crossings and landings being carried out over a wider front than formerly.

Marches.—On account of the difficulty and loss of time attending the movement of large forces to a flank when near the battle-field, endeavours will be made to arrange all marches so that the army may be in the most favourable position for carrying out modern tactics on the battlefield with the smallest amount of alteration of plans. Envelopment being now most sought for, and most to be guarded against, the tendency on both sides will be to make the flank marching columns at least as strong and probably stronger than those in the centre, and thus allow the normal battle order to be formed with the least amount of friction. Thus an army of five army corps or five divisions marching by three roads might place two on each of the flank roads and one in the centre. Two army corps of three divisions each, marching by four roads, might have two divisions on each flank road, and one on each of the centre roads with the corps artillery. In 1870 this system was not carried out by the Germans, and the tendency was to make the centre column the stronger on the march as in battle.

The same reasoning tells us that "supporting distance" between columns has become a more elastic term, and columns may march further apart, where roads suit, than in the past. Thus the front of an army will be more extended, and the amount of country overrun

and available for requisitions will be greater. This means increased work for the cavalry screen, and therefore it is, to say the least, premature to think of reducing the proportion of that arm.

Conclusion.—For such operations as are sketched above, a high standard of training is still more desirable than formerly, and, except for passive defence, armies cannot be raised to the required standard by a few months' drill. Reserves soon forget their training and lose their marching power, thus swamping the efficiency of those still serving with the colours when war breaks out. Yet reserves are a necessity, and those soldiers whose period of service with the colours is longest are (other things being equal) least likely to become inefficient.

Officers of all ranks have more responsibility thrust on them, and have to think and act by themselves for the general good more than ever. Staff Officers, in particular, require to be more highly trained in their work in order to make it possible to carry out such delicate operations as night marches and the various combinations above foreshadowed. All this leads us to imagine that the smaller highly-trained force will be able to beat those larger masses of men whose training and discipline have become rusty, in the future as in the past.

Discipline is more than ever essential where so much freedom is given to individuals, but this discipline must suit the character of the nation. Thus, the blindly obedient Russian soldier and the stolid German must evidently require discipline of a different sort to the more independent-minded Anglo-Saxon.

Decentralization must be the watchword in fire discipline, ammunition supply, and staff arrangements. The whole organization and tactics of an army depend for success on the highest training it is possible to give to human beings, and the army to which it is given wields indeed an enormous power. Like a modern racehorse, however, whose powers require the constant care of the trainer to keep them in a state of development, an army will lose half its might unless cared for and directed in its work by the highly-trained General and his subordinates. The difference between the trained army and the mob is now, perhaps, wider than ever, and every improvement in weapons requires more and more training to develop the new power placed in men's hands.

Ammunition Supply and Transport.

Supply of Infantry Ammunition.

Necessity for Ample Supply.—It is not necessary to enlarge on the absolute necessity for an ample supply of ammunition being ensured to the soldier on the battlefield. That is sufficiently obvious to all. Only second to it in importance is the question of replenishing that supply after the battle is over. Bazaine[1] states that it was owing to the deficiency of the French in the latter respect that he did not

[1] Procès Bazaine.

renew his attack on the exhausted Germans at Mars-la-Tour on August 17th, 1870. Even by the 18th, the French 6th Corps had not, according to French accounts, refilled their pouches since the battle two days previous. Should these allegations be true, and we have no reason to doubt them, a great part of the responsibility for the disasters which befell the French rests on this failure of their ammunition supply system. Thus the question resolves itself into two headings:—

(1.) Supply for a battle.
(2.) Additional supply available for the following day.

Dealing with these in turn, let us consider what number of rounds is necessary for the infantry soldier in action.

Expenditure in late Wars.—Examining the question by the light of previous experience of the results of improvements in firearms, we find that, in 1866, the Austrian expenditure was sixty-four rounds per rifle in Bohemia. This was with muzzle-loaders.

The expenditure of the Prussians in the same campaign with the breech-loader was only seven rounds per rifle.[1] This is a remarkable fact, even though it be discounted by the large amount of ammunition probably thrown away during the Austrian retreats. Yet it is evident, if there be any truth in these figures, that the possession of a rapid-firing weapon by the Prussians did not increase the ammunition expenditure on the *average of the campaign.* Therefore, *any large increase of the stores of ammunition at the base and parks far in rear of the army seems unnecessary.*

Expenditure on the Battlefield. — But we cannot found any arguments for settling the amount to be available per soldier on the battlefield on the *average* expenditure, either in a campaign or in a battle. The only guide which can be made use of is the maximum amount expended by small bodies on the battlefield. It is stated that at Skalitz and Tratenau[2] some of the Prussian companies expended 80 to 100 rounds per man. At St. Privat the French fired away all their ammunition, nominally ninety rounds per man, but, as previously remarked, the corps holding that part of the position had not full pouches. Perhaps the greatest expenditure which has ever taken place with breech-loaders was at Tashkessen, where Baker[3] states that many of the Turkish battalions fired away nearly 300 rounds per man. Yet even this high figure is stated to have been exceeded in the fighting in Spotsylvania by the Americans with muzzle-loaders, for it is related that on one occasion as many as 300 to 400 rounds per man were fired.[4] It will be observed that in both these last two instances this remarkable expenditure was incurred strictly on the defensive. The greatest amount per man expended on the offensive was perhaps in the action at Champigny during the siege of Paris, where the French[5] had 108

[1] "Mayne's Fire Tactics," p. 281. [2] *Ibid.*
[3] "War in Bulgaria," vol. ii, p. 160.
[4] "Battles and Leaders of the Civil War," vol. iv, p. 174.
[5] Mayne, p. 281.

rounds per man, and eventually had to retire from want of ammunition. The greatest expenditure by the Russians in 1877–78 in one day is stated at ninety-four rounds per man, and this may be taken as on the offensive.

Greater on Defensive than on Offensive.—It will be seen, therefore, that the expenditure on the defensive is generally greater than on the offensive. The reason for this is simply that the defenders begin firing at longer ranges, and that a good part of the attackers' time is taken up in advancing. The tendency was also emphasized in the case of the French and the Turks by their being armed with longer-ranging weapons than their opponents, though at Tashkessen the Russians were equally well armed.

Increased by want of Fire Discipline and Artillery Preparation.—It must also be pointed out that, in many cases, on the defensive there was little pretence of fire discipline, and in the attack—as at Champigny—the advance was conducted with little or no artillery preparation. Under these circumstances, it is evident that the absence of a good system of fire discipline and of adequate artillery preparation causes a largely increased expenditure of ammunition. The obvious deduction is that the better the troops are trained in fire discipline, and the more correct the tactics of the General, the less will be the number of rounds fired, and, consequently, the smaller need be the number carried. The extra power of a rapid-firing weapon is due much more to the amount of projectiles it has the power of throwing *in a short space of time* than to the number it *actually* fires off. The reasons for this will be found discussed under the heading of Quick-firing Guns.

Experiments.—Turning to the field of experiments as a guide—but one on which we must beware of placing too much faith—it was found that at Cassel, in 1878, the XIth German Army Corps, trained in the new principles of fire tactics, including long-range fire, expended an average of 100 to 120 rounds per man in three or four hours' manœvres, conducted naturally with much greater economy and coolness than would be the case in battle.[1] Captain Mayne adds one-half more as allowance for loss and increased consumption due to the excitement of battle, making 180 rounds per man necessary to be taken into the fight with *single loaders* in future. The Russians, on the other hand, consider 120 rounds sufficient. We prefer to take the mean and fix the number at 150 rounds per man with single loaders.

The Question with Magazine Rifles.—Turning to the same question with magazine rifles, it is stated, both by Colonel Slade[2] and Captain Mayne, that it has been proved by experiment "that the continuous fire of magazine rifles is only more rapid than that of ordinary breech-loaders while any cartridges remain in the magazine, and that there is no general gain in rapidity of fire in filling it again as soon as empty." This statement may now have to be modified if other nations follow the example of the Austrians, and load entirely through the magazine; and Captain Mayne justly points out that an

[1] Mayne, p. 282.

[2] "R.U.S.I. Journal," "Modern Military Rifles and Fire Tactics," vol. xxxii.

intermittent fire, such as is to be expected in battle, in which the magazine is used and refilled during the pauses, the expenditure will be much greater than with single loaders. No limit can now be put on the number of rounds able to be fired through fatigue resulting to the firer; for the present small-bores have far less recoil than the rifles out of which the Turks fired nearly 300 rounds per man at Tashkessen. It is therefore to be expected that—with small bodies more particularly—the number of rounds fired may run up to even 500 or 600 per man on the defensive, *when there is bad fire discipline.* An efficient system of fire discipline will, however, change the aspect of the question. By fire discipline all long-range fire will be kept strictly under control, and ammunition will not be wasted in independent firing at immense ranges as was done at Plevna and at Gravelotte. But as the combat gets hotter and closer ranges are reached, as Officers and non-commissioned officers fall, so the strain on men's nerves becomes greater, and may soon cause them to disregard the words or signals of the few remaining leaders. Finally, uncontrolled magazine fire may become the order of the day on one or both sides. Before long one side or the other will give way and retreat under a hail of bullets. By undisciplined troops this stage would probably never he reached, for all their energies and all their ammunition would have been expended in long-range firing, as indeed happened many times during the latter part of the Franco-German War.

Number of Rounds Necessary per Rifle with Trained Troops in Battle. On the Offensive.—All things considered, and allowing for possible insufficient artillery preparation, it is considered that troops well trained in fire discipline should enter into an attack with 200 rounds per man actually on the soldier's person, or 50 more than with single loaders. There should also be additional rounds available for conveyance to him when chances occur during the fight. In fixing the above large number it must be borne in mind that the soldier's courage evaporates in the same proportion as his ammunition, and that it is extremely problematical whether reserve ammunition can be conveyed to him during the combat.

On the Defensive.—The figures of ammunition expenditure for the defence are usually so much greater than for the attack that we would wish to ensure 300 rounds per man to a force holding a position. This figure has also the approval of Colonel Slade,[1] and ought more easily to be supplied for the defence than the 200 for the attack, for in the former case ammunition columns can come up more easily, and boxes of ammunition can be placed at intervals along the line.

Number Necessary to Refill Pouches and Carts.—In addition to the above amount, there must be ample means of filling up empty pouches at the end of the day, so that in the future a General may not be prevented, like Marshal Bazaine, from renewing a drawn battle under more favourable circumstances the following morning. As, however, it is unlikely that the *average* expenditure per man in an Army

[1] "R.U.S.I. Journal," "Modern Military Rifles and Fire Tactics," vol. xxxii.

Corps would exceed 150 rounds in a day's hard battle, it ought to be sufficient if the Divisional and Army Corps columns carry that number between them, thus making a total of 350 rounds per man with the army in the field.

Scale recently adopted in Foreign Armies.—Table A shows the views of foreign nations on this important subject, and it will be seen that the most recent change—that of Germany—is in the direction of providing the soldier with a largely increased supply on his person, so as to render him more independent of reserve ammunition. On the other hand, France, while carrying fewer rounds available at once for battle, has a large reserve with the ammunition columns ready to refill pouches at the end of the day. The tendency, however, to increase the ammunition supply does not yet appear exhausted, and the above cannot be regarded as final. Every decrease of weight brought about by smokeless powder, the substitution of aluminium for brass in the cartridge case, or other change of matériel will be made use of to increase the number of rounds carried.

This question of weight prevents our loading the soldier with the whole 200 rounds we have fixed on as necessary for a battle. Mobility being, next to fighting efficiency, the most important essential to an army, it is desirable to keep down the weight on men's backs as much as possible. The proportion of weight of the M.H. cartridge to that of our new weapon is as 70 to 115. Thus the soldier can now carry 115 rounds without increase of weight. It is desirable to augment this to 120, and economize weight in some other portion of his kit. Thus the clothes brush might be dispensed with, and the water bottle lightened by being made of vulcanite; even the cape might be left with the baggage in temperate climates, and every effort made to lighten the soldier's packs.

Method of Carrying the Ammunition on the Soldier.—As to the way in which this ammunition should be distributed on the person of the soldier, the methods at present in use in the various armies may be studied with advantage.

France.—With the old rifle 78 rounds were carried, viz., 36 in pouches on the belt and 42 in the knapsack.

Austria.—Each soldier carries 100 rounds, viz., 60 equally divided between two pouches in front, and the remaining 40 in a larger pouch behind. This pouch has also a division for iron rations. The waterproof bread bag can also be used for ammunition. The three pouches are fixed on the waistbelt independent of the knapsack straps, so that the latter can be removed without depriving the soldier of his ammunition and reserve rations.[1]

Germany has copied the Austrian method, and carries 60 rounds in two pouches in front and 90 in a large pouch behind.[2]

Russia.—84 rounds on man—30 in pouches and 54 in knapsack.

England.—40 in pouches and 30 in valise (old equipment). The new equipment is not settled.

Of the above methods, the Austrian manifestly presents many

[1] Mayne, p. 292. [2] "Transfeldt," 1890.

TABLE A.

How carried.	Supply of Infantry Ammunition.						Remarks.
	France.	Germany.	Austria-Hungary.†	Russia.‡	England.‡	Proposed scale.	
By the soldier	112·0	150	100†	84‡	70‡	120	* These are the figures given with the old rifle by Captain Mayne, but probably they will be altered to suit the new one, just as the number carried by the soldier has been increased to 150. † Old magazine rifle. ‡ Single loaders. § 16 boxes of 1,100 rounds each per cart.
Battalion reserve in carts, &c.	26·5	38*	35	48	30	80§	
Total available at once	138·5	188	135	132	100	200	
In divisional or 1st échelon column	66·4	30*	48	52	40	50	
Total supply for battle.....	204·9	218	183	184	140	250	
In battalion baggage wagons	2·6	11*	—	—	10	18	
In A.C. or 1st échelon column	46·5	30*	32	10	30	82	
Total supply by next morning	254·0	259	215†	194‡	180‡	350	

References, France.—"Regulations for the Supply of Ammunition in the Field," and "Aide-Mémoire de l'Officier d'État-Major," July 1st, 1890.
Germany.—"Transfeldt," 1890, and "Armed Strength of the German Empire."
Austria-Hungary.—Mayne's "Fire Tactics."
Russia.—"Armed Strength of Russia."

advantages. The extreme importance of a man being able to remove his valise without depriving himself of his ammunition and rations is sufficiently obvious, as also the advantage of being able to get at his reserve ammunition without removing his valise or screwing his hand behind his shoulders to get at it in an impossible position. By this method the Germans carry 150 rounds, so that the British should find no difficulty in carrying 120, leaving room at the same time for extra rounds to be given out before battle. As regards the weight on the belt, those who shoot with cartridge belts well know how little inconvenience is suffered from them when the belt is buckled very *loose*, so that the weight rests on the *hips* and not on the stomach. The reason is simply that the hips are the natural supporters of weight, and are close to the centre of gravity of the body; here the breathing is not interfered with, and the arms and shoulders are left perfectly free for using the rifle. What is required, then, is an equipment similar to that of the Austrians or Germans, and men must be encouraged to loosen their belts to the necessary extent whenever they march with full weights. A pair of large breast pockets should also be provided to contain extra rounds in case the haversack contained rations. The men should be trained to use the extra ammunition first, and to reserve that in their front pouches for close ranges, as being most easily got at. Spare magazines might be carried in their front pouches.

Distribution of Remaining Rounds.—The remaining 80 rounds of the 200 would be carried by the battalion carts and mules,[1] while of the extra 150 rounds per man, it seems desirable that 50 should be carried in the divisional ammunition column to fill up empty battalion carts during the fight, and the remaining 100 should be distributed between the battalion baggage wagons and the rear sections of the army corps ammunition column so as to be available when the battle is over. This proportion takes account of the difficulty of replenishing the supply during a fight, a difficulty which does not exist with artillery to a like degree.

Supply of Artillery Ammunition.

Rate of Firing Increased.—In settling the amount of ammunition necessary per gun, we are not handicapped by want of previous experience as in the case of magazine rifles. The gun is still a single loader, and likely to remain so, except possibly for horse artillery acting with cavalry. However, the use of brakes for checking recoil, the system of carrying shell ready fuzed and increased rapidity in setting the fuze, probably the introduction of metal cartridge cases, percussion locks, and traversing gear to enable the layer to dispense with the services of the man at the handspike, and certainly the introduction of smokeless powder—all these will increase the rate of fire to a considerable extent, while the increased amount of artillery preparation now necessary renders it probable that, for the assailants at least, a much

[1] Each cart carries 16 boxes of 1,100 each, and each mule 2 boxes. Total, 74,800 per battalion, or about 80 rounds per rifle.

larger expenditure of ammunition will take place in the future than in the past. When both sides intend being assailants, and the artillery duel is hotly contested, the expenditure will reach a very high figure. But against this must be set the fact that shrapnel fire is now more effective than of old. Flesh and blood can only stand a certain amount, and every shell being now more effective than formerly, and at the same time the rapidity of fire being increased, the decision of the artillery duel, *once the range is found*, must occupy a shorter time, provided neither side seeks artificial cover. Yet firing will commence at longer ranges, and much preliminary ammunition expenditure will take place where the ground permits of such ranges.

Past Experience.—If we look for guidance to the experience of past wars we find that the expenditure of the fifteen batteries of the Prussian Guard at St. Privat was at an average of 100 rounds per gun,[1] and the fight was not begun in this part of the field till about 2 P.M. In a battle commencing much earlier in the day the expenditure might have reached 200 rounds per gun, especially if the hostile artillery had been able to make a better fight. At Mars-la-Tour, the great artillery battle, some batteries almost attained this amount. The 1st and 3rd horse artillery batteries of the IIIrd Army Corps fired 191 and 194 rounds per gun respectively,[2] and the *average* of the whole fifteen batteries of the corps was 130 per gun, and would have been much greater had ammunition been available. Hoffbauer says:[3] "The deficiency of ammunition experienced in the afternoon, more particularly on the right of the position, ... had its influence in checking the detaching of batteries (to other parts of the line where wanted). The slowness of their fire and the actual silence of some of them encouraged the enemy to make more frequent and vigorous attacks." Then he states that the German attacks from the Bois de St. Arnaud received no direct support from artillery, and were consequently unsuccessful. Later on, he continues: "the account of this battle teaches that, owing to great expenditure of ammunition, the first line of wagons of the ammunition columns should follow the troops as closely as possible . . . . and that the number of artillery ammunition columns should, as a rule, be increased in that (the first) line." Prince Kraft tells us that this was done after Gravelotte, and half the infantry first line columns were turned into artillery[4] columns. It may be remarked that this could not so easily have been done had their infantry columns consisted of our S.A.A. carts. The same high authority says he is "convinced that the quantity of ammunition which we carry, whether with the batteries or with the columns, is not sufficient. You cannot safely reckon, especially in the case of decisive battles where such great masses of troops are collected to take part in the decision, upon the columns being able to make their way through the combatant troops during the very day of battle. We must, therefore, fill up the limbers and wagons of the

[1] Prince Kraft, "9th Letter on Artillery."
[2] Hoffbauer.
[3] Hoffbauer, "The German Artillery," translated by Captain Hollist, p. 135. Prince Kraft, "9th Letter on Artillery."

batteries with as much ammunition as they can possibly consume during the whole length of a day of battle." He then goes on to show how if the battle of St. Privat had commenced in the morning and not in the afternoon, the batteries must have fallen short, owing to the divisional columns having been used to fill up the empty boxes of the IIIrd and Xth Corps engaged two days before, leaving the Guards' batteries dependent on the army corps columns in rear. After the 18th August all the columns were exhausted, and they had first to go to the park at Herny to the east of Metz, round by Pont-à-Mousson, only to find even that depôt exhausted. Then they proceeded by forced marches to Saarlouis on the frontier, where they filled up, and only just arrived at Sedan in time for the battle, a fortnight after Gravelotte. It is evident that a similar risk ought not to be run in future. Ammunition columns and parks must carry sufficient to prevent their being entirely emptied by two such days of battle. For though there were two days of hard fighting, yet the guns which fought on the 16th took comparatively little part in the expenditure of the 18th.[1] Therefore the total expenditure was not much more than might have been incurred in one long day of battle. At Solferino it is stated that some guns fired as much as 300 rounds each.[2]

Number of Rounds arrived at as necessary in Future.—Taking all things into consideration it seems desirable that 250 rounds per gun should be available for the day's battle, *i.e.*, should be carried with the batteries and 1st echelon of columns, of which at least 150 should be with the batteries, for the columns may not get up till late, as Prince Kraft says, or not at all; also, that 100 rounds per gun additional should be available by the following morning, *i.e.*, with the rear sections of the army corps column; and that 50 to 100 rounds per gun be with the advanced park. Colonel Walford, R.A., in a lecture at Shoeburyness,[3] enters minutely into the question of the time by which it may be expected that the ammunition columns will arrive on the field, and calculates that in the case of an army corps marching by one road only, the various divisional columns will arrive on the scene in ample time for the renewal of ammunition, but that the 1st Section Corps Ammunition Column will not arrive till 1 hour 20 minutes after the shrapnel with the corps batteries may be expected to have become exhausted. But these calculations are made on the supposition that there will be no blocks on the road, that an action is expected and the ammunition columns are closed up to the tail of the combatants, and that each divisional column will immediately follow its own division on the line of march. It is extremely doubtful whether this order of march would be followed, and appears more likely that when the time came the divisional and 1st section corps column would march together in rear of the combatants of the army corps, as indeed is expressly laid down should be done in the French regulations. In this case it is calculated that the ammu-

[1] *Vide* Hoffbauer's Tables.
[2] "Revue du Cercle Militaire," 5th January, 1890, p. 3.
[3] "R.A.I. Journal," September, 1890.

nition columns would not reach the batteries till 5½ hours after the commencement of an action.[1] It seems to be more suitable that any extra ammunition transported with the combatants should actually belong to each battery or field artillery division. If all the ammunition columns marched together in rear, the supply with the batteries would evidently very soon run short, if on the present scale in our service of 108 rounds per gun. Therefore this number must be increased largely, and, though not coming within the scope of this paper, so long as common shell are mere range-finders, the percentage of them carried might be reduced, as suggested by Colonel Walford, to about 20 per cent. of the whole. But in order to be able to effectively destroy matériel it would be necessary to follow the example of the French and add a wagon full of melinite shells per battery.

It is a curious fact that with the old 9-pr. R.M.L., our batteries carried 148 rounds per gun, or with second line of wagons provided in India, 256 rounds per gun. Now that breechloaders have been introduced and firing has become more rapid all round, the number of rounds carried per battery has been largely *diminished.*

Comparison of English with Foreign Ammunition Transport.—Table B shows the measures foreign Powers have taken as compared with England, for providing for the expected extra expenditure of ammunition. An examination of this table will show that:

(1.) England has a much smaller supply of rounds per gun *with the battery* than any other Power, except in the case of the Russian 27½-pr.

(2.) The English battery has fewer ammunition wagons per battery.

(3.) England allows for a smaller *total* supply of ammunition in the field per gun than any other Power for guns of similar calibre, in spite of the rear sections of our army corps column carrying a larger proportion per gun than any other Power.

(4.) Though our horses are stronger and better, and though our gun carries a lighter shell than any other field battery gun, yet the number of rounds carried per wagon is considerably less than in the wagons of France and Germany, and the total weight of these rounds is, with the exception of the Russian horse artillery, much less than in the case of foreign Powers.

(5.) The weight of our ammunition wagon empty is much greater for the weight of ammunition carried in it than those of foreign Powers. Thus the German field battery wagon empty weighs 21½ cwt., and carries 1,617 lbs. of ammunition, while the English wagon empty weighs 23¾ cwt. and carries only 1,188 lbs.

Deductions.—Thus England is inferior in all questions of economy of power. *The weight of ammunition drawn by six English horses could actually be comfortably carried on six average pack animals.* It is perfectly evident that the construction of our wagons leads to an enormous waste of power; *weight*, not *strength* of construction, ap-

[1] "Revue du Cercle Militaire," 9th February, 1890.

TABLE B.—*Supply of Artillery Ammunition.*

Where carried.	France.		Germany.		Russia.			England.	Proposed scale.	Remarks.
	Field battery.	Horse battery.	Field battery.	Horse battery.	Light field.	Heavy field.	Horse battery.	H.A. and light field.	Light field.	
Rounds per gun with battery	141	156	135	153	150	108	130	108	156	* Allowing 15 batteries per army corps and cavalry brigade, the corps artillery being allotted the same number of rounds as the divisional batteries.
1st échelon ammunition column	62	87	57	67	135	108	135	74	95	
Total for battle	203	243	192	220	285	216	265	182	251	
2nd échelon ammunition column	54	61	57	67	43	30	43	77*	100	
Total in field	257	304	249	287	328	246	308	259	351	
No. of rounds per wagon	76	87	77	86	80	45	55	72	90	
Weight of each round	22 lbs.	16½ lbs.	21 lbs.	14 lbs.	18 lbs.	31½ lbs.	18 lbs.	16½ lbs.	16½ lbs.	
Approximate weight of ammunition carried per wagon drawn by 6 horses	1672 lbs.	1415 lbs.	1617 lbs.	1204 lbs.	1440 lbs.	1410 lbs	990 lbs.	1188 lbs.	1485 lbs.	
Weight of empty wagon	28 cwt.	21¾ cwt.	21½ cwt.	21 cwt.	23½ cwt.	23½ cwt.	20 cwt.	23¾ cwt.	21½ cwt.	
No. of ammunition wagons per battery	9	* 9	8	8	16 (8 guns)	16 (8 guns)	12 (6 guns)	6	8	
Weight of shell	17 lbs. 10 oz.	13 lbs.	17¾ lbs.	12¼ lbs.	15 lbs.	27½ lbs.	15 lbs.	12½ lbs.	12½ lbs.	

References. *France.*—"Regulations for the Supply of Ammunition in the Field," "Aide Memoire de l'Officier d'Etat Major," and "Aide-Mémoire de Génie et d'Artillerie."
Germany.—"Armed Strength of the German Empire."
Russia.—"Armed Strength of Russia."
England.—"Manual for Field Service," Royal Artillery, 1889.

pears to be the ruling principle, and our Arsenal cannot be congratulated on the results achieved. There is no reason whatever why our light field artillery should not be provided with a wagon carrying at least ninety rounds of ammunition (13¼ cwt.) and weighing 38 cwt. packed, including 3½ cwt. for kits and equipment. If this were done we should be able to carry our 156 rounds per gun with eight ammunition wagons per battery, but with the present wagon ten of them per battery will be necessary to reach that amount. In short, as our artillery is at present constituted, nothing less than an addition of three wagons per battery will place its ammunition supply on at all a satisfactory footing. This will give 144 rounds per gun with the battery. With the horse artillery the case is similar, but the necessity for both lighter guns and wagons was sufficiently shown in the late cavalry manœuvres in Berkshire. As stated elsewhere, the question may probably be settled by the introduction of a 7- or 8-pr. quick-firing gun, or lower velocity 12-pr. for the batteries with the cavalry division. In the latter case a lighter wagon could surely be constructed to carry 72 rounds.

Composition of Ammunition Columns.

English and Foreign Ammunition Columns.—The principal foreign nations keep their infantry ammunition columns distinct from the artillery columns, and the Germans have the wagons of each of these columns painted a distinctive colour, those of the infantry being grey and the artillery blue. There does not appear to be any great advantage in this division, and all that seems necessary is that the infantry part should be easily detachable and easily distinguishable. The French form their artillery columns into two groups which usually march together, the first group consisting of twelve artillery ammunition wagons and two spare gun carriages, and always marching at the head of the column; the second group being the remaining wagons, corresponding to our ammunition and store wagons. The English divisional ammunition column consists of 6 artillery ammunition wagons, 11 ammunition and store wagons, 1 spare gun carriage and 34 S.A.A. carts, for which the only Officers allowed are 1 Major, 2 subalterns, and a quartermaster.

Proposed Divisional Ammunition Column.—To enable this column to transport ammunition on the scale proposed, viz., fifty rounds per infantry soldier, 95 per gun, and 8,000 per machine-gun, or a total of nearly 400,000 rounds of S.A.A., 1,710 artillery rounds, and 32,000 machine-gun rounds, we get—

398,400 rounds S.A.A. at 1,100 per box....	24 S.A.A. carts.
32,000 „ machine-gun ammunition ..	2 „

or a total of 26 instead of 34. This saving may be used to provide extra artillery wagons.

810 artillery rounds at 90 per wagon.....	9 artillery ammunition wagons.
864 „ „ at 144 per ammunition and store wagon....	6 wagons.
36 „ „ in the spare gun carriage.....	1 carriage.
1,710 rounds. Total carriages ..	42

For the proper management of this column of 42 carriages, exclusive of store wagons, there should be a complement of 1 Major in command, 1 Captain and 1 subaltern for the infantry portion, and 2 subalterns for the artillery portion, besides a quartermaster to assist the Major. With this organization the column will be capable of being split up without detriment.

Carriages.—With regard to the carriages, the S.A.A. cart leaves much to be desired. In its present form it can be used for nothing else except S.A.A., and the present cartridges are so strong that separate compartments for each box appear quite unnecessary. The balance changes with each box taken out, and cannot be adjusted. An open cart with a canvas cover as suggested by Captain Harris appears all that is desirable, and the weight saved could be used for extra ammunition or entrenching tools.

1st Section Corps Ammunition Column.—The 1st Section of the Corps Ammunition Column might also be made to carry 95 rounds per gun of the corps artillery, and the ammunition part would then consist of 15 artillery ammunition wagons, 4 spare gun carriages (2 appear sufficient), and 10 ammunition and store wagons, together with S.A.A. carts for the corps battalion and details. For this, a Major, 3 subalterns and a quartermaster might suffice. In all 1st echelon columns the artillery ammunition wagons should head the column on the march, followed by the S.A.A. carts.

2nd Echelon Columns.—The 2nd échelon columns do not require to be able to move so rapidly, and therefore instead of six horses per ammunition and store wagon, the same might be drawn by four animals of a heavier class, such as are to be seen in brewers' drays in England. They would seldom have to go off the road, and might therefore be driven from the box. By this means the length of the column would be considerably reduced without any loss of traction power. The wagons loaded with S.A.A. and weighing when packed 49 cwt. might even be brought up to the weight of those loaded with artillery ammunition, viz., $52\frac{1}{4}$ cwt., and their number reduced in proportion.

Instead of splitting up the 2nd échelon columns into three sections, it would seem better to have the same number of sections as exist in front, viz., four, each of which would be capable of being

detached with troops acting independently, and would carry a proportion of rounds corresponding to those in front. Thus the 2nd, 3rd, and 4th sections would be similar to divisional columns, while the 5th would act as 2nd echelon to the 1st section corps column, with a small section attached to it as 2nd échelon to the cavalry divisional column. The 2nd, 3rd, and 4th sections would thus each carry about 630,000 rounds of S.A.A. and 1,800 artillery rounds, and would consist of 17 ammunition and store wagons for S.A.A. (including one for machine-gun ammunition) and 12 ammunition and store wagons for artillery ammunition, with 1 or 2 spare gun-carriages. The 5th section would be constituted in a corresponding manner. As the corps artillery are, however, unlikely to fire away so many rounds as the divisional batteries, the number of rounds per gun in this section might be reduced to 60 or 70. For each of these a Major, two subalterns, and a quartermaster should be sufficient, as there would not be so much detaching of wagons as with the 1st échelon columns.

Having disposed of the question of the supply of ammunition necessary with an army in the field, and where it is recommended to be carried, the method of passing on this supply from rear to front on the day of battle will now be examined.

Replenishing Expended Ammunition.

In Captain Mayne's "Fire Tactics" will be found a précis of the regulations of most armies on this subject, so far as concerns infantry. Generally speaking, ammunition wagons have to follow troops in action as closely as possible, and privates trained as carriers distribute ammunition from the wagons to the fighting line. Therefore unless the wagons are brought close up and probably exposed, it seems impossible to distribute an adequate supply by this method.

Principles to be followed in arranging for Ammunition Supply.—Let us now examine into the principles it is necessary to follow in arranging for the replenishment of ammunition:

It is obvious that the nearer troops get to the enemy, the more hotly they become engaged, and the less under control; therefore, the greater becomes the difficulty of attending to such matters as refilling pouches, their whole attention being fixed on the enemy *in front.* Under these circumstances no complicated method of supplying them with ammunition, and no system dependent on a few privates for being carried out, will answer. Simplicity is the soul of warfare, and any such complicated system will fall to pieces under the stress of an enemy's fire. If picked men are chosen as carriers their example is lost to the firing line in front and their movements to the rear at a critical moment might be misinterpreted by their comrades. But the further to the rear we go the steadier the troops are found to be, and the more their attention can be directed to helping their comrades in front.

1st Principle.—Therefore it is evident that *any method of supplying ammunition under fire in order to be successful must be dependent on the troops in rear, and not on those in front.*

Again, the hotter the fight, the less desirable is it that ammunition should have to be distributed while it is going on, for it exposes the carriers and carts and wastes the time of those firing, many of whom will be too excited to notice the packets of ammunition thrust into their hands. In fact, *it seems impossible to distribute ammunition to infantry during the critical stages of the combat, i.e.*, within 700 yards of the enemy, and it is stated that the Austrians and Germans are recognizing this fact.

2nd Principle.—Therefore another principle deduced is that *the men must carry on their persons to the critical stages sufficient ammunition to ensure a successful ending to the attack.* From this it follows that the ammunition used during the early stages should be supplied as far as possible from the ammunition carts or wagons, so as to leave those carried on the person for the close attack alone. This principle is carried out in the various armies by distributing extra rounds before an action takes place.

Means of conveying Ammunition under Infantry Fire.—It seems a risky experiment to bring carts and wagons under infantry fire, in these days of smokeless powder, as is contemplated by most nations, for such large objects are bound to attract fire, where a single horse or mule would escape unobserved. The ground, too, may forbid the advance of a heavy vehicle, and it is a misapplication of a man's strength to make him a beast of burden. Therefore, the most suitable means of conveying ammunition into the firing line, when it can be done, appears to be pack animals. Each mule easily carries two boxes, each with 1,100 rounds (new rifle), weighing 171 lbs. in all. Therefore, our two mules per battalion carry 4,400 rounds, or about 15 rounds for each man of a firing line of 300 men. The advisability of doubling the number of mules per battalion may be considered.

Distribution of Extra Rounds before entry into Action.—As previously mentioned, we propose to distribute eighty rounds per man on entry into action, but this number need only be given to the firing line and supports, and a reduced number to the reserve companies, thus leaving the mules and perhaps one cart untouched. Or if working in brigade, the brigade reserve formed in our Service might supply the extra eighty rounds per man to the battalion or battalions which first advance to the attack, allowing their two carts and mules to accompany them intact, and ready to take advantage of pauses in the combat. On the defensive these extra rounds might be supplied from the ammunition columns, but on the offensive it is not likely they would be up in time. Naturally, the replenishment under fire might be helped by rounds carried by Officers and non-commissioned officers, and those taken from the dead and wounded by the "battle police." However, the great secret will be to start the men off with sufficient ammunition in the first place, and never to let the mules and carts be separated from their battalions on the march.

Replenishment of Artillery Ammunition under Fire.—The difficulty of supplying ammunition to artillery under fire is not nearly so great as with infantry, for the distance from the enemy is longer and the number of units of fire much smaller. However, the same principle

holds of working from the rear to the front, and leaving the commander of the battery to concentrate his energies on the shooting. As a general rule, the ammunition should be supplied from the wagons first, commencing at the wagon bodies, the limbers and teams being under cover and full wagons being sent up from the échelon in rear when required.

Systems at present laid down.—Table C gives, as shortly as possible, the system of supply in the artilleries of England, France, and Germany, when likely to remain long in one position. The methods pursued are evidently very similar in England and Germany, in spite of the severe condemnation by Prince Kraft[1] of so many échelons of wagons. In France, however, there are important points of difference. Unlike the former countries, France lays down that the empty wagons arriving from the guns shall remain with the "échelon de combat" till full ones arrive from the ammunition column, when their contents are transferred to the battery wagons. The French[1] also, by the order of December 28th, 1888, have dispensed with the intermediate échelon of wagons, and consider that it only complicates matters and renders supervision difficult, especially when batteries suddenly change position. The distance of 550 yards in rear of the guns has not to be exceeded, and is thought to give sufficient immunity from fire. The English battery has evidently an advantage in possessing a Captain to look after the wagons and regulate the supply. All three countries lay down, however, that the commander of the battery or group has to send for ammunition when required, instead of leaving the regulation of the supply to those in rear, though the French regulations encourage initiative in this direction on the part of the sergeant-major in charge of the wagons. The Italian regulations differ from the above, and lay down that the battery wagons, when empty, are to proceed at once to the 2nd échelon of the *ammunition columns*, their places at the batteries being supplied from the 1st échelon column by requisition from the battery, thus involving a change of carriages.

The chief point worth noticing about the Russian system is that the carriages are fitted with interchangeable trays, each containing three heavy or five light shell, while a similar number of cartridges are also packed in interchangeable cartouches. Thus a small supply can be left with the gun while the carriages are under cover, and packing empty carriages is facilitated.

New French Idea.—It is said that the French propose to do away with the 1st line battery ammunition wagons altogether, and to substitute two limbers for each wagon, with forty rounds each, drawn by two horses and interchangeable with the gun limbers. When the gun limber is empty, it is to proceed at once to the nearest wagons of the ammunition column to be refilled, and its place taken up at the gun by another limber from the rear. Thus the lead and centre horses are permanently under cover. The wagons of the ammunition

[1] "9th Letter on Artillery," "R.A.I. Edition," p. 94.
[2] "Revue du 1er de Militaire," 2nd February, 1890.

TABLE C.—*System of Artillery Ammunition Supply of a Battery in Battle when likely to remain long in one Position.*

	ENGLAND.		FRANCE.		GERMANY.	
	Echelons.	Remarks.	Echelons.	Remarks.	Echelons.	Remarks.
Fighting line.	Guns, 2 wagons.	Wagons unhooked.	Guns, Limbers, 3 wagons.	Limbers move under cover when long in action, and guns are supplied from wagons, which return to "échelon de combat" when empty.	Guns, 3 wagons (unhooked).	When these wagons are empty they return to 2nd line, whence they are *sent to the ammunition column* to be refilled by detachments.
First line of supply.	Gun limbers and 2 wagons (under cover) in rear of flank under Captain, about 100 yards from guns in open country.	Empty wagons from the guns are sent *direct to the ammunition column* to refill, and their places supplied at the guns by this 1st line.	No corresponding 1st line.		Gun limbers and 3 wagons, 230 yards from guns.	These wagons take the place of those with the guns when the latter are emptied, and 2nd line wagons then move to 1st line. *All this done by order of the battery commander.*
Second line of supply.	2 wagons under Q.M.S., about 900 yards from 1st line in open country.	Massed under an officer when three batteries are working together. When 1st line moves to guns, 2nd line moves up to 1st line.	*Echelon de combat.* 6 wagons under sergeant-major, 550 yards from GUNS in open country.	3 wagons move to guns when sent for. Empties from guns *remain with this échelon.* S.M. sends to ammunition column for full wagons when empties arrive, and *contents are transferred here.* "Echelons de combat" are massed under an Officer in groups of batteries.	2 wagons, forge, &c., 620 yards from 1st line.	These are grouped together under an officer (when near an enemy) by abtheilungs. On emergency, wagons can be sent direct to guns from the ammunition column.
Third line of supply.	Divisional ammunition column or 1st sec. A.C. col., 1,000 yards from 2nd line.		Divisional or 1st échelon ammunition column, about 1 mile from guns.	Divisional column halts 3 miles in rear for orders, and if battle proceeds favourably, it is brought up to within a mile of the batteries.	Divisional or 1st échelon column.	

References. *England.*—"Field Artillery Drill," Vol. II (1889).
France.—"Revue du Cercle Militaire," 2nd February, 1890.
Germany.—"German Field Artillery Exercises," 1889.

N.B.—The distances from the front are not to be exceeded, and usually depend on the cover afforded by the ground.

Information given elsewhere regarding Italian and Russian systems is taken from "Istruzione per l'ammaestramento tattico dell' Artiglieria," and from the Russian "Field Artillery Drill Book."

column are to be packed with interchangeable limber boxes, so that a limber can at once be supplied with fresh boxes full.

There is a simplicity about this method which is very taking, but the weight of the limber boxes to be lifted on every empty limber is an objection. Probably the Russian system of packing is preferable, for it can be done by one man. It is doubtful, also, whether two-wheeled vehicles are as good over rough ground as ammunition wagons, but certainly limbers such as the above are vastly preferable to the heavy ammunition carts tried at Okehampton in 1889. The latter carried sixty rounds and required four horses to drag them, thus no saving of animals or men was effected, and the weight on the two wheels was far too much for soft ground.

Transmission of Orders.—The chief difficulty in keeping the machinery of ammunition supply in working order lies in securing the rapid and correct transmission of orders to the échelons in rear, and in the latter finding out what they may be required to do. In connection with this it is interesting to study the latest regulations worked out by the French on the subject.[1] All connection is established from rear to front by means of "agents de liaison" or representatives from each échelon in rear, which are attached temporarily to the échelon next in front. Thus, each 1st échelon ammunition column sends a non-commissioned officer to follow the commander of the group of batteries to which it is affiliated, and two (in case a battery were detached) to the Officer in charge of the "échelon de combat" of the group, while the latter, in turn, has a similar representative with each battery or group commander. Even the limbers, when under cover, have an "agent de liaison" with the commander of the battery. When any orders or communications have to be sent to the bodies in rear, these "agents" convey them, each to his own échelon, and return to their stations immediately the orders are executed. Each will also remind the commander to whom he is attached of anything forgotten in regard to his échelon, and will keep himself informed of everything pertaining to it. By this means it is hoped that communications may be kept up without the slightest hesitation, and certainly there seems good reason for the belief.

Proposed System.—By combining the good points of the above systems with the principle of working from the rear to the front, we arrive at the following system:—

Every carriage with the batteries and 1st échelon ammunition columns should be packed with interchangeable trays of ammunition, each tray containing three or four rounds complete. This could easily be done if brass cartridge cases were introduced. The "agents de liaison" system should be established throughout. The wagons of the battery or group (except those with the guns) should be all kept together under a Captain, not more than 600 yards from the guns in action, and that Officer should regulate the supply of ammunition to the batteries in concert with his "agents," with whom he could

[1] "Revue du Cercle Militaire," Feb. 2nd, 9th, and 16th, 1890.

communicate by an orderly. He would thus be kept informed of the exact state of the ammunition expenditure, and could replace empties without troubling the commanders of batteries. He would also get due warning, through his "agent" with the group commander, of any contemplated change of position. Wagons, when nearly empty, would place their remaining full trays on the ground, and proceed to the Captain in rear. Meanwhile, the latter Officer will have sent the A.C. "agent" to his ammunition column, and on arrival of full wagons their contents will be rapidly transferred to the empties by means of the trays. Should time press the teams might be exchanged, for it is of far greater importance to keep the same horses and men with a battery than the same wagons, and the time taken to change teams and take off a few gunners' kits would be very short compared with repacking, if every shell and cartridge has to be separately transferred. In case of emergency, the wagons of the column might go direct to the guns, but as the horses will be untrained to stand fire and the drivers inferior, it is advisable to avoid this when possible.

The 2nd line of wagons of each group of batteries might be massed together on the march when near the enemy, and follow in rear of the body of troops to which they belong.

Movements of Ammunition Columns.—With regard to the proceedings of the ammunition columns, the same principle of working from the rear should be followed out. The commander of the column must do his best to anticipate the wishes and wants of those engaged in the all-absorbing combat. News of battle travels fast, and may probably reach him before either of his "agents" arrive from the front. In spite of every care it will frequently happen that he receives no orders, and will have to act on his own initiative. This he must be encouraged to do, and must press on to the front. In default of orders he should halt the main part of his column just off the road, when he judges himself to be within 2 or 3 miles of the guns, and send off two sections immediately, each under an Officer, one to the artillery, consisting of the nine artillery ammunition wagons (in the case of divisional columns), and the other of about eight S.A.A. carts, to find their respective arms in action. These vehicles, like all ammunition wagons or carts, should be painted a distinctive colour, or be provided with distinguishing flags, so as to catch the eye of the "agents," or others hunting for them. The ammunition column commander and his subordinates are much more likely to be successful in finding the position of their division in the fighting line than are a few empty carts or wagons from the front to succeed in discovering the whereabouts of their ammunition column. The sounds of the firing, and the wounded men and stretcher bearers passing to the rear, will be never-failing guides to the Officers of the ammunition columns on nearing the field of battle. Prince Kraft[1] relates how the 2nd échelon ammunition column at Thiancourt, on the 18th August, 1870, marched to the sound of the guns and came in time to supply the place of the emptied 1st échelon. Such action should be the rule, and not the exception. Even should the empty

[1] "9th Letter on Artillery."

carts and wagons from the front find the column and get refilled, they might have considerable difficulty in reaching their respective units again, unless commanded by an Officer. "When a regiment of infantry or cavalry encounters a few wagons commanded by an unhappy non-commissioned officer, will it let them pass? No, it will take them for a part of the train. . . . and will drive them into the ditch."[1] On arrival of the sections at the front, the "agents," or those in charge of the brigade S.A.A. reserve or groups of battery wagons would soon see them as they passed along the rear of the line. The carts or wagons could be exchanged, or have their contents transferred according to the emergency of the case. Should no extra ammunition be required, the sections of the ammunition column could remain as a reserve till wanted. Their non-return would be taken by the commander of the column as a sign that no more were required. Should they return with empties, they could refill and again start for the front if it was seen that a fresh supply was likely to be required. Once connection is established in this way the rest is easy, and the ammunition columns could advance to any desired spot and their whereabouts be made known to all concerned. In the same way the 2nd échelon ammunition columns would draw near to the front as soon as news of battle came, either through their "agents" with the 1st échelon columns, or otherwise, and sections of them might be sent up to the columns in front to refill them if desired.

Paper Work.—All red-tape in the way of written requisitions and receipts must be done away with in stress of battle. With regard to this Prince Kraft remarks,[2] "When a man is readily venturing his life from moment to moment at the call of honour and duty, he thinks it hard to be required to render an account of expenditure when perhaps he may, within the next half hour, make settlement in full with his life's blood, and even if a corps should render a false return to the amount of 10,000 rounds, it could be done without detection merely by showing 10,000 extra cartridges expended. But who would ever dream of embezzling cartridges in time of war? . . . . Therefore you must, when in the field, give up controlling your expenditure of ammunition by double entry." He then goes on to explain that he was taught by experience that the demand for periodical ammunition returns only delayed the issue without being any real check on the consumption. The only real check possible or necessary, in our opinion, is for the A.C. column to tick off the number of wagon-loads delivered to the divisional columns. As this would represent the actual expenditure in refilling pouches and carts, it would really be the expenditure on the battlefield by the various divisions. Closer than this it seems unnecessary to go. As bearing on this, it may be mentioned that, after the Suakim Expedition in 1885, nearly all the ordnance store accounts had to be wiped off as hopeless.

[1] "Revue du Cercle Militaire," 2nd February, 1890, p. 91; also Prince Kraft's "9th Letter on Artillery."

[2] "R.U.S.I. Journal," vol. xxix, p. 785.

Advantages claimed for the System.—By the system explained above it is claimed that—

(1.) The work is more equalized on the field of battle, those in rear having their active duties as well as those in front.

(2.) The attention and duties of every combatant are concentrated on his *front*, and no combatant soldiers leave their regiments for the rear unless wounded. This ought to be a gain to *morale*.

(3.) There is greater rapidity in the supply of reserve ammunition, and that supply is more certain.

(4.) Empty carts and wagons returning to the rear *after* having delivered a fresh supply of ammunition to the combatants can do so more leisurely if they know the supply is ample for some time, and they can, in such a case, be made use of to convey wounded to the field hospitals, which will naturally be established near the ammunition column.

Conclusion.—We cannot do better than conclude by quoting Prince Kraft's summing up of the question of ammunition supply in the future:[1] "It will be doubtless necessary for ammunition columns to detach wagons to different parts of the fighting line, and we must make up our minds to this. Troops actually engaged must make a point of completing their ammunition at all times without waiting for orders whenever they get a chance of doing so, whilst the leaders of ammunition columns following out of fire must consider it a sacred duty to meet the troops to which they are attached half way, and to furnish them with supplies, and also *without awaiting orders*, which the General might neither have the time nor the means to send in the heat of battle."

Ammunition supply, under the present regulations, shows too much centralization to work well in battle. In this, as in other matters, *decentralization* must be the ruling principle, and only by making the personnel of ammunition columns responsible for the timely supply of ammunition to troops in action, and for always keeping full up the wagons of those in front, can this principle be carried out in its entirety.

[1] "R.U.S.I. Journal," vol. xxix, p. 786.

Friday, February 27, 1891.

GENERAL SIR C. P. BEAUCHAMP WALKER, K.C.B., Vice-President, in the Chair.

ON THE UTILITY OF AN ELEMENTARY KNOWLEDGE OF GEOLOGY TO THE OFFICERS OF THE ARMY AND NAVY.

By Professor T. RUPERT JONES, F.R.S., F.G.S., &c.

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INTRODUCTION.—*Maps.*—Before setting foot on a country new to them the Officers of the Navy or the Army, like ordinary travellers, ought of course be already provided with the best available maps of the district. These may be only outline maps, simply showing by hatching and other signs the hills and dales, rivers and lakes, woods and fields, farms and towns, and such like. These would, of course, be valuable, as showing relative distances and some natural features. A contoured map, however, would be still more serviceable, showing exactly the flats, slopes, and precipices; and therefore the most accessible and the most difficult passes, as well as the easiest grades for roads. If, however, the map be geologically coloured, it would indicate among other things the probable *consistency* of the ground in the valleys and on the hill-slopes, and to what extent in length and breadth, how far and in what directions, the hard and the soft materials, such as clay, sand, sandstone, limestone, schist, and granite, stretch along or across the district under notice. Hence such a map would be of far more value than the uncoloured maps; warning the road-maker, for instance, to avoid some treacherous flats and some sliddery hill-sides, before ever he put his foot upon them.

Geological Map.—The use and value of a geological map can, of course, only be appreciated and applied with some knowledge of the principles and practice of geology. Geological Science comprises (1) a knowledge of the various materials of which the Earth is com-

posed; (2) how they are arranged one with another; (3) how they came into their present position; (4) how we can most conveniently lay hand on those materials which we specially want, and prove that they are exactly of the kind required, or in the relatively right places where we wish to use them.

Geological Science.—In the first place, to obtain a real knowledge of the rocks and minerals is to many a pleasant task, but involving time and labour, with hammer and pocket-lens in the field,—microscope, chemicals, and other appliances in the study; and for fossiliferous rocks a knowledge of zoology and botany. Some amount, however, of useful acquaintance with geological and mineralogical specimens can be acquired by earnest practical study in a limited time much less than a professional teacher has to give to the subject. Secondly, as to the natural position, arrangement, and appearance of rocks, whether stratified or unstratified, experience can be got only in the country, in cuttings, pits, quarries, mines, and cliffs. Thirdly, both books and direct observation have to be brought to bear on the facts and deductions as to how the many kinds of strata and the various masses of unstratified rocks were formed and arranged. These are the manifold results of the action of water and ice, disintegrating the earth's surface at some places, and rearranging elsewhere the materials so removed; and the more striking, but not more effectual results of heat and water combined in volcanic eruptions and deep-seated disturbances and changes. Fourthly, we come to Geological Art, or application of the Science. To those who cannot give years to the study of the principles of a science success in practice of the art must be limited, whether they pose as physicians, surgeons, chemists, painters, engineers, actuaries, or actors. Some handicrafts can be practised empirically by rule-of-thumb. Amateur photographers may be successful without an acquaintance with the origin of their chemicals, the laws of light, and so on. So also *to some extent* Geology may be practised as an *art* by Officers of the Army and Navy, and by intelligent travellers and tourists.

Fortunately now-a-days some instruction in natural philosophy and natural history, including geology, is given in schools and enlightened homes; hence we have not all to begin quite in the dark when it is desirable or necessary to take up geology as a definite and practical study. Taking this for granted, let us see how we can acquire, and how we can profit by an elementary knowledge of this useful science.

Geological Facts.—Whatever may be the aspect of any place not covered with buildings, we may be sure that some or other of the earthy or stony substances common all over the Earth constitute the subsoil and ground-work. The soil itself bears evidence of its real nature by the vegetation (natural or cultivated) covering it; and the bare rocks have their peculiar lichens, mosses, and weeds, and even larger plants holding on at ledges and fissures. These are helps to any one looking for indications of geological structure. Equisetum (horse-tails) on clay, and Pteris (bracken) on sand, are good guides in our latitude; and a mere stick plunged into one or the other will be a practical witness.

Dry places and wet do not occur indiscriminately, but have those conditions in accordance with the relative water-holding power of the soil and subsoil. Sand and clay are usually concerned here also; but, if the same kind of topographical features have not been seen and accounted for before, digging and cutting below the surface will be required. Some gravel heaths offer good camping ground; but under the top gravel lies a continuous irony bed, and this usually impermeable "pan" will retain the water of sudden heavy rainfalls, and cause the ground to be supersaturated and soaking-wet in every tent in a night, unless knowledge shall have previously examined the locality and broken through the hard "pan" at proper places.

In valleys and flats, besides the cuttings (if any) for roads and drains, the riversides and ravines would give some indications; but better far the upper courses of the streams and torrents, with rapids and waterfalls, expose the hard rocks in the hillsides. If he has no map, the observer will have to pace and plot the ground in his note-book, and indicate on his plan, as it grows, the occurrence of definite bands of stone, or beds of clay and sand; noting, not only their characters and thicknesses, but especially their inclination (if any) to the horizon ("dip"), and the direction by compass, in which their exposed edges ("outcrop") stretch ("strike") along the country, if they stand out visibly; or their probable line of strike, if only partially exposed.

Structure.—Hills with Horizontal Strata.—The knowledge of natural materials, already alluded to, and an acquaintance with the geological clinometer and the compass, are thus required at the outset. Given that the strata lie horizontally, one above another, in the section seen in going up the hill, it is evident that the same set of strata lie throughout the hill; and consequently that the edges of the hard and the soft beds can severally be found (even if not indicated by ledges and scarps) along the hill-side, and around the curved end of the hill or range, and even on the other side, if it be there flanked by a valley. Thus, if a road has to be made across the hill, it would be known that necessarily it could be made up one side and down the other over the edges of the *same* seams, layers, beds, and banks of limestone, sandstone, clay, &c., but in reverse order. If a road had to be made round the hill, its line could be chosen on the outstanding edge of a solid rock (or in a nitch cut in it) all the way. Springs would probably be issuing on some of the clays between the hard strata, and they could be avoided by the road passing along on a ledge of the rock above them. If a good road-metal were found in one of the hard sandstones (for instance), it need not be quarried at one place and taken to another part of the hill; but it would be known to occur just at the same horizon along its outcrop on the other side.

Hills with strata inclined inwards.—Should the strata exposed on the hillside be found to dip into the hill, their edges on the outside would be available for ledges just as in the former case; and very good for a road, as the drainage would soak inwards in or on the several beds. They would not, however, be found on the other side,

for there the hill would slope away, either with the topmost bed, or it would consist of different strata, higher in the series, and overlying the others at the same angle ("conformably"); in either case this back of the hill would have a grade corresponding with the dip of the beds; this is known as a "dip-slope." It would afford such footing for pathways, and surface for roads as the nature of the particular stratum, or possibly successive edges of strata (towards the top), exposed on the slope would allow, whether thick or thin, continuous or fragmentary, tough or friable.

Hills with strata dipping outwards.—If, on the contrary, the strata inclined outwards, that is towards the face of the hill-side, the latter would be modified by the broken and fallen pieces of rock from harder ledges undermined by the weakness of soft beds beneath them. Of course, a good road could not be made here except at enormous expense.

Whatever the condition and features of the hill-side they would be continuous along the scarps and slopes as far as the hill or hill-range extended. Hence in sketching the country a geological draughtsman would be saved the trouble of going to find out at every mile or so the local character of ledge, hollow, bevel, or slope; for he would know that it was due to certain strata which he had under notice where he stood, and the nature of which he could trust to be the same for great distances. Even if the hill be isolated by the dislocation of the strata, the features might be taken up again by the succeeding hill.

Hills with Synclinal Strata.—Advancing further into the unknown territory the traveller meets with hills, in crossing which he finds the structure to differ from that of those already passed, inasmuch as the "dip" is directed inwards *on each side* of the range, which in consequence consists of a "syncline;" that is, if exposed by transverse ravines, the strata are seen to be bent downwards, either with a concave curve, as inverted arches, or sharply let down, and even broken with the fractured edges meeting at a strong angle. Having been competent to recognize these facts, to what purpose can the observer apply his knowledge? In the first place, the trough-shape, or still more the basin-shape, of the bent strata enables them to retain all the rain that falls on the top and soaks down to an impervious layer. Hence the surface bears grass and herbage,—some springs come out on the scarps when the underground water rises above the edges of the synclinal strata, and wells can be dug with a certainty of supply. These conditions are far more certain than in the hills with inclined strata, and even in those of horizontal beds. "Synclinal hills have often been hill-fortresses, both on account of their retaining moisture enough both for pasture and for wells, and their presenting precipitous sides. The strongholds of Persian chieftains on the Turko-Persian frontier (Loftus), and Schamyl's last retreat, Gounib in Daghestan (Campbell), are examples." Majuba Hill may come within this category of hills with either synclinal or horizontal strata. Of course these valuable spots of ground have been incidentally met with and utilized by nomads and others; but the educated eye recognizes the where, why, and wherefore,

not at haphazard, but by systematic knowledge without loss of time and trouble. Schamyl was defeated only by a continued supply and untiring succession of men climbing by means of iron holdfasts in the exposed edges of the strata in the precipitous sides. Sometimes a neglected or an unobserved attack may be made by mere bold climbing.

Many mountain-tops (as Snowdon, for instance, and hundreds elsewhere) owe their height to the hardness of synclinal strata, compressed downwards and inwards by the concave bending and folding, whereby the particles of rock-material, both mechanically and chemically condensed by the pressure, have thus resisted denudation more successfully than the complemental anticlinal folds of the same rock-sheets.

Hills with Anticlinal Strata.—In these latter curvatures the strata, unable to bear the tension, have been broken, opened out, and destroyed bit by bit by natural agencies, often leaving valleys of great extent ("valleys of elevation," exposing lower and lower strata as "inliers"). To be certain about the nature of the two sides of such a valley, the surveyor must, of course, measure the amount of dip in the strata on both sides. If it be the same, the "anticline" is simple and true geometrically, whether cracked and fissured in the middle or not. If the dip on opposite sides of the valley be unequal, the surveyor finds accordingly such differences in the capabilities of the two stretches of country as modifications of hills with inclined strata must present.

An anticline, however, need not be worn down very low. The strata of its two upthrown sides may be continuous, as an arch; or, if broken, may have their edges resting against each other, usually with some shifting or dislocation ("fault"). "In one case the unregarded anticlinal position of the Chalk of Portsdown Hill (C. Evans) spoilt the hopes of the Royal Engineer boring for water. In another case, a knowledge of an anticlinal arrangement of the strata of Trimpley Hill enabled the late G. E. Roberts to point out how the axial, but unexplored, limestone might be got at, and burnt for lime with the coal lying against the foot of the hill. Hills having the same outline may be composed of very differently arranged strata; and, until some evidence of their actual constitution is gathered by a geologist, no one can tell any more of their interior than a child can of pies or dumplings before they are cut open."

Thus on account of the various modifications in the arrangement of strata, "some hills have their contours coincident with the outcrop of their strata, which are then horizontal; other hills may have synclinal, cycloclinal, anticlinal, or periclinal strata, with very different results as to smoothness of slope, step-edges, water-bearing qualities, native fertility or barrenness, &c., according to their petrological characters—clays, sandstones, limestones, &c."

Schistose and Granitic Rocks.—We have hitherto alluded to countries constructed of simple strata of limestone, sandstone, clay, and their varieties; but there are many other rocks,—some more or less schistose and slaty, some solid like granite,—some partly massive and partly in sheets and veins, as basalt, lavas, and whinstone dykes, &c.

After passing over maritime flats and river-plains, and crossing such hill-ranges as have been indicated above, in nearly every country the traveller finds that the easy-lying strata have been more and more disturbed from the horizontal position to undulating, curved, folded, and distorted conditions, as he examines the gorges and ravines of the higher ground and mountains; he notices here and there the veins, dykes, and bosses of intruded rock; and ultimately finds that the true strata have disappeared into compressed sheetings of laminated rock, often splintery and shillety, or tough, or even crystalline, lying and standing at all angles and often vertical. These pass into crumpled mica-schist, foliated gneiss, and solid granite in the heart of the mountain-regions. All these kinds of rocks have their peculiarities as regards the structure and aspect, capabilities and uses of the ground and districts which they constitute. In some instances the nature and constitution of the uplands and higher regions can be at least partially judged of by an examination of the gravels and boulders brought down by streams and rivers, whether issuing from springs on the mountain-side, or from the foot of a glacier which has originated on the crest of the ridge.

Fossiliferous Strata.—Of the ordinary low-level districts, however, there is much to be noted before these complicated and altered rocks are taken in hand. The important fact—that all the known strata have a definite order in place one on another, according to their relative order of deposition, has to be borne in mind. According to their relative age they are marked, signed, and, so to speak, certificated, with fossils peculiar to each, or at least to each consecutive group of strata.

As time passed on with its millions of centuries, changes took place in the relative extent of seas and lands, and in the heights of the one and depths of the other, bringing about many changes both in the living-places and feeding-grounds of animals of all sorts, and in the growth and distribution of the plants. Hence some creatures dwindled and disappeared; while others took their place and flourished. Thus with every successive group of animals and plants ("fauna" and "flora") inhabiting land and water there were differences of individual shape and structure, due to either improvement or deterioration; and there were gradual changes, from the "generalized" to the "special," ruled by the Creator's great and wonderful law of "Evolution." Hence the "organic remains" buried in the deposits of seas and lakes, and variously preserved as fossils, have to be looked for and noted. Those of the oldest rocks (first-formed and lowest in the geological series) are known as the Palæozoic ("old-life series"); the next great group above are the Mesozoic ("middle-life series"); and the uppermost group are the Cainozoic ("recent-life series"). They are also known as the Primary, Secondary, and Tertiary; and the youngest portion of the last is divided off as the Quaternary. These are also divided into several "Formations"; as (1) the Archæan, Pre-cambrian, Cambrian, Silurian,[1] Devonian, Carbon-

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iferous, Permian; (2) Trias, Rhætic, Jurassic (Lias and Oolite), Purbeck and Wealden, Neocomian and Cretaceous; (3) Eocene, Oligocene, Miocene, Pliocene, and Recent.

Thus it is advisable for the surveyor to be able to recognize Trilobites, Graptolites, &c. as Cambrian and Silurian; Bronteus, Pterichthys, &c. as Devonian; Productus, Lepidodendron, &c. as Carboniferous; Palæoniscus, Axinus, &c. as Permian; Ceratites, Labyrinthodon, &c. as Triassic; Microlestes, &c. as Rhætic; certain Ammonites, Reptiles, &c. as Jurassic; Iguanodon, Cypridea, &c. as Purbeck-Wealden; certain Fishes, Echinoderms, &c. as Cretaceous; and certain kinds of fossils for the Tertiary and each of its divisions.

Use of Palæontology.—Coal-beds.—The utility of this knowledge ("palæontology") is extensive. By ascertaining the fossils of a stratum you know whereabouts in the geological series it really lies; and therefore whether or no it is above or below any specially valuable stratum or formation that you may be looking for. If, for instance, you want to put your hand on coal:—in search for the great beds the old coal, that is, the true coal of the Carboniferous Period, you would not look at the lower outcrops of Devonian and Silurian strata, but go higher and higher on upper outcrops, and find the Carboniferous above them both, if it be present in that part of the country. In sinking pits the same rule would be followed; and the trouble, annoyance, and cost of trying to find coal in or below the Devonian, &c., would be avoided; whereas the Permian, and possibly the Triassic, rocks might be bored through with some hope of finding the coal. Accurate observation of stratigraphical arrangement, or the stratal structure of the country, might show in some regions that even higher strata than the Permian lie directly upon the Coal-measures; for in Belgium the formations intermediate to the Carboniferous and the Cretaceous are wanting (from old denudations, &c.), and the latter lies immediately and "unconformably" on the coal-beds. From the study of different outcrops and borings, across the South of England and parts of France and Belgium, the probable depth and condition of real coal at great depth, even below the London district, have been fairly deduced.

There are, we know, other fossil fuels beside the old coal. Some of these are well worth getting; and some are of slight value, and even deceptive to non-geologists. How are they to be looked for? Like many other useful things, including real coal, they have been found by natives or others, noticing them incidentally as they lived on the spot or passed across the country. Hence many such "finds" may have been known for ages in the locality before they got by hearsay into legends and old writings; now-a-days, reported by native and other traders, emigrants, or casual travellers, they find their way to civilized centres in paragraphs of Newspapers, and do not always escape those who write books of travel. Thus the whereabouts of many promising mineral substances are made known; but their proving to be attainable and good depends upon the applied science of the Engineer and the Geologist. Coal is met with in other rocks than the Carboniferous, but rarely fit for more than local use. It is

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found in the Permian and Trias abroad; in the Jurassic in Britain and Austria; in the Purbeck, at Brunswick; in the Cretaceous of Poland, Vancouver, &c.; and great Tertiary Lignites in the Western Territories of the United States and Canada. Many a poor lignite in England and elsewhere has deceived sanguine people who might have learnt its real value by what the neighbouring strata show it to be.

Hence the necessity of knowing the aspect and composition of these fossil fuels,—the relative age of the strata with which they are imbedded,—and the relative position of those strata with regard both to others and to the surface.

Geological Materials.—In fact, a competent acquaintance with all the common rocks and minerals is desirable; so that sandstone should not be mistaken for limestone,—white quartzite for statuary marble,—lydite for black marble,—green jasper (blood-stone) for serpentine,—bottle-glass for obsidian,—blue glass for sapphire,—quartz for diamond,—or pyrites for gold. Such knowledge also guides in the choice of limestones for building, or for making lime, or for cement,—in the selection of stone for road-metal,—of clay for firebricks, pottery, tiles, and common bricks,—and in the recognition of useful materials at hand, and prevention of the ordering of similar rock from a great distance. These points are dwelt upon in my Address on the Practical Advantages of Geological Knowledge, in the "Proceedings of the Geologists' Association," vol. vi, 1880, pp. 237—270.

Conclusion.—An American author[1] truly states—"Geology now plays an important and prominent part of Military Science as well as in the curriculum of universities, although a few years since it was all but unknown to either. It now not only guides, as it ought, in the direction of mining and other practical geological operations, but also gives the key to the study of obstacles in military art."

In my paper on the practical use of geology above referred to, it is noticed that the sites of battle-fields, the lines of ancient roads, the elucidation of history by explanation of changes of coasts and river-bends, are all to be worked out with reference to Geology; and much interesting work has been done in this direction.

"The races of India have been conquered by the British, and to a great extent her rocks and soils were conquered by amateur geologists of the British Army. Before the Geological Survey of India was instituted about thirty Officers and twelve Army Surgeons had communicated valuable observations on India to the Geological Society of London."

An educated Traveller, an accomplished Staff-Officer, and a Naval Surveyor, may use geological knowledge to advantage in a scientific journey, in a military reconnaissance, and in surveying coasts and islands. Either of them with geology "can see further than a mere surveyor! He can see more than the outline of hill and vale, or of gorge and peak! He can see which of the hillsides is sandrock or limestone or granite, with all their certain or probable properties or conditions! He can see where a valley has its floor of porous

[1] A. W. Vogdes, Lieut. U.S. Artill., "Course of Sciences applied to Military Art. Part I.—Geology and Military Geography. Geology." 1884. Page 2.

gravel, or of light loam, or of stiff clay, or of black peat! What is more, he can appreciate their relative value, or their relative evils, to him and to others! He traces the run of clay-bands, or of hard rock along or across the country! He can tell what is on the other side of some hills he looks at,—nay—even what he may expect to find on the other side of a mountain-range! He sees the rolling and pitching of strata to right and left, from hill to hill; and he knows what further strata they bear on their broad backs, east or west, north or south. The escarped side of a hill will tell him whether the back-ground is a plateau, flat or sloping, good for roads, or made up of rifted rocks and crumpled strata, impassable! He knows whether yonder ridge, dividing the valleys, continues the dry sandrock, the grassy limestone, or the barren granite of the neighbouring mountains! He knows *reasonably* a volcanic cone, a trappean knoll, a basaltic cliff,—also their possibilities and values. He will not set compass on such a rock, for he would lose his direction; he would not lay telegraph-wires on them, for his electric slave would rebel at their touch! He can tell where water lies in the synclinal or the faulted strata, for his indication is the knowledge of observation, not the ignorance of the 'dowsing fork' or 'divining rod,' for which, indeed, the Australian savage, watching the gnats dancing over a water-spot, ought to have a supreme contempt.[1]

"He knows whether the strata in a plain slope from the mountain or towards it, and therefore how the water soaks and runs beneath. As a General of genius, or the educated Soldier, 'has an eye for a country,' for positions and manœuvres, so the Geologist has an eye for the capabilities of a country. The earth is open to his educated eye, just as a diagram may show surface and section. Further, he can enjoy the varied tints of morn and eve, and sketch with pleasure the lights and shadows of Nature's architecture, as well as those who know only the outside; whereas his knowledge of the *structure* adds pleasure to his enjoyment, gives distinctness to his touch, and renders his description of each part, high or low, rough or smooth, definite and to the purpose."

The value of geology, in a military point of view, is not lost sight of in Lord Wolseley's "Soldier's Pocket-book," 5th edit., 1886, p. 244. In the "Manual of Field-fortification, Military Sketches, and Reconnaissance," published by Authority (1871), a knowledge of geology is insisted upon as absolutely necessary (p. 156). Indeed, it is therein stated that, "In the present day a Survey and Report upon a country would not be considered complete unless it contained some amount of geological information."

In the "Journ. Royal United Service Instit.," vol. vi, p. 342, F. W. Hutton, 23rd Royal Welsh Fusiliers, F.G.S., states, "As Geology is the most useful of the sciences to a soldier, so is a soldier's profession the one of all others best adapted for its study."

[1] See General Portlock's valuable remarks on the advantage of cultivating the Natural and Experimental Sciences as promoting the social comfort and practical utility of Military Men, "Journ. Royal United Service Institution," vol. iii, 1859-60, p. 296.

The CHAIRMAN: Gentlemen, having listened to Professor Rupert Jones' very instructive lecture, it is my duty to invite discussion.

Brigade-Surgeon STAPLES: There seems to be a great reluctance to follow Professor Jones in his lecture, and I must say I do not wonder at it. I have only risen because of that great reluctance, and not to occupy the ground which I hope my temerity will induce combatant Officers to take up presently; but to say a few words for one section of the army Officers who are alluded to by Professor Jones, I mean the army Surgeons. In my experience, an elementary knowledge of geology, of all other allied sciences, is the most useful to them, in some of the questions upon which we are called to give a responsible opinion to a General or commanding Officers. These questions, of course, cover a great deal in relation to the sites of camps and barracks, where we are associated with the Royal Engineers, questions of health with regard to soil, &c.; but I want to draw particular attention to the question of water supply, and I wish to illustrate what I have to say by practical experience. I think that will be the best plan to make myself intelligible to the meeting. In two stations in which I was quartered when I was in the Army, I had a great deal to do with giving a responsible opinion on the question of water supply. One I will not refer to, but the other I wish to particularize. It was a station at which there were two sources of supply. The geological formation seemed, as far as I could make out from the map, to be the same; that is to say, it was what I think geologists call an amorphous sand, lying upon shale and limestone. It was not a difficult problem, with a certain knowledge of chemistry, to give an opinion as regards the water, and yet the latter was absolutely different in the two sources. I never could explain it, and in time came home from the station and gave up the subject. It was to me an intense puzzle. One day in London, and some years afterwards, I was passing the School of Mines. I went into the library, and asked the librarian if there was any gentleman in the place who had paid attention to the question of geology and water supply, if he would kindly introduce me to him. It is a little embarrassing that I am speaking in the presence of the gentleman himself, but I hope he will kindly excuse me. He listened to what I had to say very kindly, and after I had put the question before him, he said, "Have you a geological map of the place?" I said, "Yes." I do not want to be pedantic, or for it to appear that I had a great knowledge of geology, for such was not the case. I only want to bring out some of the points kindly put upon the board by Professor Jones. He said, "What is the formation bounding this sandy plain?" I said, "That is limestone." "Can you show me a section of the limestone?" I got him one, and he then put the case of the water supply quite clearly. The difference simply depended on the stratification of the limestone. Opposite one source, I think what the Professor called the "inclination" of the limestone was more or less horizontal, or approaching the horizontal; it inclined in such a way that the rain falling upon it rushed out over the sandy formation and impregnated it with lime. Above the other source the stratification was almost vertical; the water sunk into the limestone and did not reach the sand, hence the difference in chemical composition. I think any one can draw the conclusion from the foregoing that an army Surgeon would be better equipped scientifically if he had a good elementary knowledge of geology. It seems to me at all events that, if they had, their opinion on questions relating to water supply would be much more authoritative and better than it is. I thought these few remarks would enable others to get up and say something as regards the lecture, from their particular points of view.

Major SMITH, R.A.: I, like Dr. Staples, consider myself unworthy to speak on this occasion, as I, too, am only a student of geology; but I am encouraged by the fact that a great part of what I have learned was picked up under the learned Professor's own teaching. My remark is a very simple one. Dr. Staples has drawn attention to the use which a slight knowledge of geology may be in explaining certain difficulties connected with water supply. It is my misfortune to have to look through some 200 or 300 reconnaissance reports of very varying merits, which are pitchforked at my head every year from the Home District. I find in nearly every one of these an attempt made to give a general description of certain areas of country round London, and in nine cases out of ten it proves a somewhat egregious failure; and I believe this failure—this utter inability—to be able to describe tracts of country

in language which is at all concise, or which will commend itself to scientific ears, is simply the effect of want of knowledge of elementary geology. Any Officer who had a slight knowledge of this character could describe in very few words almost every area of country you ever meet with round London. It is quite sufficient in most areas, simply to say a certain village or district lies direct upon the London clay, nothing intervening, or perhaps upon the Thames alluvium; that another place is simply on the outskirts of the chalk-downs, just two or three words like these convey a perfectly adequate knowledge to any expert in the question on nearly everything you want to know, whether for administration or more directly tactical purposes—the question of water supply, the manufacture of roads, the convex or concave curvature of the hill-slopes, or anything you like to know. The elaborate circumlocution which persons have to employ in describing the most ordinary physical features of English country who have not that geological knowledge shows what an extremely desirable thing it is to possess some acquaintance with the elements of the science which the Professor has been advocating. With regard to the lecturer's remarks on the field of Gravelotte, I find myself, unlike the schoolboy in Macaulay, in the painful position of having to confess my entire ignorance of the obvious connection between the "Inferior Oolite" (which I think he mentioned) and the bad strategy, or worse—the moral obliquity of poor Marshal Bazaine. Perhaps, in his concluding remarks, he will kindly enlighten us as to the simple, yet subtle, linking of cause and effect in this case. It would be interesting also to hear something about the physical structure of Inkpen Beacon, which he purposely omitted. If I am not mistaken, the cavalry manœuvres of this past year took place not far from there; and it strikes me that on these two points some information would be very grateful to the audience.

Mr. RUTLEY: There are many extremely interesting points which Professor Jones has touched upon in his lecture, and he has no doubt done very wisely in restricting his remarks to questions mainly of stratigraphy, because there are some stratigraphical questions in connection with strategy which are of great importance from a military point of view. For example, that of water supply is of paramount consequence. The search for coal is of course a matter which is of deep interest in times of peace; in times of war there would be, however, few opportunities of making suitable investigations. The questions which Professor Jones touched upon towards the end of his lecture were most suggestive, and it is to be hoped that his discourse may be the precursor to another, in which he will deal with the relative strength of positions, and the influence which geology has upon them. Of course, in the teaching of geology to the various branches of the Service, it is a matter of great moment to dwell upon the different characters of the ground, how in certain districts only boggy ground may occur, or soil which is so incoherent that it is perfectly unfitted for purposes of transport, or for the passage of artillery. That seems to me one of the chief points to consider, and the proximity of such a boggy position to one which could command it, and from which forces could inflict very severe damage upon an enemy, whose knowledge of the country was less thorough than their own.

Mr. TOPLEY: The field covered by Professor Jones is so large, and he has put the matter so very clearly before us, that I will not attempt to follow him in all the numerous points he has referred to; but will limit myself to two points. First, as to the importance of geological maps in aiding us to understand topography. Professor Rupert Jones commenced his lecture by some remarks upon that point; but a great part of what he said subsequently was bearing out his introductory remarks, and showing how very easy it is with a little geological knowledge by studying a geological map to understand the features of a country infinitely better than it is possible to do with only a hill-shaded, or even a contour map. The geologist sees at a glance the whole look of the country from a geological map, however small the scale may be, much better than any one can do from an ordinary map which does not show the geology. Of course, if we have both, if we have a carefully hill-shaded or a contour map, and also a geological map, putting the two together, we have a more perfect knowledge of the country, and the larger the scale the better it is. Passing from that, I would like to say a few words as to the special application of some maps of the Geological Survey which I have placed

upon the table. The ordinary geological map shows the solid rocks; but frequently there are also superficial deposits covering which, when we come to study them in detail, modify the features of the country and the surface soils enormously. I have here two examples of a map on the 1-inch scale of the country on the south of London (Sheet 6); it stretches from near Godstone to beyond Maidstone. One is an ordinary geological map showing the ordinary rock-formation, the other is a map upon which the drift deposits are shown. Those two maps cover the same district. On the one map all the light green is one tract of bare chalk; on the other map, it is shown covered up by all sorts of drifts which considerably modify the soil. All the south of England is now thus mapped out by the Geological Survey. In addition to the ordinary 1-inch map, we have also larger scale maps of the district. Here is a War Office map specially prepared some years ago, and used before the 6-inch Ordnance maps were made; but now we survey the country on the ordinary 6-inch scale. The bare chalk is shown by a wash of light-green, and the various drifts overlying it are shown by tints of brown, purple, yellow, and so on. The very great difference of the soils is shown—for instance, the ordinary bare chalk makes a comparatively hard and firm soil on which cavalry and artillery could very well manœuvre. The gravel along the bottom of the valley is shown, and also some gravel on the hill-top, whilst the stiff clays which cover mostly the higher ground are clearly shown. It might be a matter of some importance for the Intelligence Department if it availed itself of maps of this kind in collecting information, say, upon such a special point as the defence of the Metropolis. What an enormous difference it would make to an army manœuvring over that country, if it could choose its positions on a chalk soil, and force its opponent on to stiff clay. The Geological Survey is constantly appealed to by engineers and others in search of water supply, by people who want sites for houses, and so on; and the value of the maps from these points of view has long been known. Just at present there is a communication going on between our office and the new Board of Agriculture to see how far the map can be utilized for agricultural purposes; but a further application, I think, might be made of them for military purposes from the point of view here described. It would surely be of considerable advantage if the information of the various surveys were collated and kept in the possession of the War Office to be made use of in such ways as the authorities thought desirable. I have here also the geological map of the country around Aldershot on the 6-inch scale, which being a special military district I thought might be of interest; this also shows the surface soils.

Professor RUPERT JONES (in reply): My observations have not been criticized, but courteously added to; indeed, the subject has not been exhausted by any means. I may recommend one or two books. First, a paper by myself, an accumulation of notes of lectures, given during my time of service at the Staff and Cadet Colleges, together with experiences gathered by the kindness of my Staff College friends, as well as from my working amongst them. It is called "The Practical Advantages of Geological Knowledge," and is published in the "Proceedings of the Geologists' Association," vol. 6, April, 1880. There are in it many things not merely military, but for general purposes. It contains the names of many army Surgeons and Officers who worked as geologists in India before the Geological Survey was instituted there; and also some Missionaries who did much towards the knowledge of Indian geology. Therein also two papers in the Journal of your own Institution are alluded to: one by General Portlock, and another by Captain Hutton, who is now the Professor of Geology in the University of Otago, New Zealand. Dr. Staples spoke of army Surgeons, and I have nothing to add to his observations. It was perfectly true that the same kind of sands at the two different places would be affected by the presence or absence of water from the neighbouring limestone: and, of course, there are many conditions to be accounted for, which would be recognized by the geological eye almost directly. Major Smith put it very clearly that geological language is short and clear. Such technical language should be used on every occasion, if possible. It is only because people do not know enough, that they will not allow such useful words to be used. Long words sometimes carry a great deal of condensed meaning. Major Smith referred to the country about Metz and Gravelotte, a model of which is before us. Now, really I acknowledge that, unless I went

over the matter again, I could not readily point out why these strata of the Inferior Oolite, dipping to the east and coming out raw and ragged over the valley on the west, with the Soft Lias clays below, should not have been more or less advantageous or otherwise in the conduct of that series of battles. Though a position on a height is good, yet if you have nobody to back you at a crisis you may as well go away. Particularly, however, I think that some of the lines there were scanty of water, because the villages could not have had sufficient water, except by means of deep wells. With regard to battlefields, it is all very well to know why a battlefield has been good, and why a battlefield has been bad in a geological point of view, after the fight is over. Such observation afterwards is pleasant and very satisfying to make; but very difficult to find out beforehand. Who can tell where the next battle will be? Any General would be guided, like Napoleon or the Duke of Wellington, by the apparent fitness of the district. The undulations of Waterloo, no doubt, struck him as being very useful, and he thought he would get the best of it, and certainly he did; but he thought little of their being formed of the Tertiary strata there. And so in many other places you can see afterwards why they were fit, and why they were good; but I doubt whether any military man would in the course of a great war, with very rapid movements, do more than trust to topographical information, and pick out the best places, partly for political reasons, of his surroundings as well as for the details of the place. Geological maps would help him in details; but he must bring his men together, I take it, according to the nations who are helping or not helping them. In the Peninsular War there were geological points here and there seized upon; but, in a great many instances, you had to take what positions you could. If you were sent to build a fort at a place, you must build it there; it is not whether it is good or bad geologically. You must be prepared, however, to know whether it is difficult or easy under the circumstances. With regard to Walbury Camp, referred to. It is on the top of a chalk-hill; and shows how clever our predecessors were in finding out and using what they wanted. This hill rises above a valley consisting partly of soft alluvium, and further on there are some Tertiary sands and clays, making a good agricultural district; and elsewhere there is an uprise of some of the beds from below the Chalk, which also can be used for agriculture. They did not think much of agriculture in those days, and these were swamps and forests. The chiefs took their positions on the high ground, which, by the way, bore the great lines of traffic, such as the "Ridgway;" and they fixed their earthworks on these chalk ranges in the neighbourhood of the roads and passes. Whether looking on the roads and fords along the valleys, or on the passes up through the chalk-hills near by, still these camps or forts always had to do with the guarding of these important lines of communication. Of course that could not be shown here, without a map having these points marked upon it. Some of us have such maps, with the roads and earthworks of the Ancient Britons, the different succession of inhabitants, and the Romans. Walbury is perched on a hill, commanding a very large area that must have been passed by people wanting to go into other parts of the kingdom, which was then divided into small territories, and conflicting parties existed, as now. Mr. Rutley pointed to the strength of positions; that comes to the same thing as battlefields and the erection of forts. You must take what you can get, and afterwards, no doubt, it is interesting to know why such battlefields were better or worse. Of course it is wrong not to know the value of details. One of the maps that has been shown to us by Mr. Topley puts me in mind of one particular point, in that terrible battle (which you must all remember) whereby London was lost, and so on—namely, the battle of Dorking. There, I am sorry to say, the English did not know their geology. They came down off the hill opposite Dorking—the hill (now Cubitt's Hill) parallel with Box Hill. I do not know where they started from, but they intended to attack the Germans on the rising ground of Dorking itself. Unfortunately there was no geologist there to tell them of the outcrop of soft Gault clay, on which the stream runs, between the high ground at Dorking and the Chalk on which the English stood, as can be seen in one or more of these diagrams. A geological Staff Officer would have said, "It is a valley of Gault," and would have known the consequences! Those handsome troopers—the Guards, I think, red or blue, rode into that valley; and of whatever colour they were when they dashed in, they were certainly blue who came out. They had rushed

into the valley—they could not cross the soft, tough, blue Gault with safety—and the battle was lost. I might have mentioned some other things with regard to clay. I remember a circumstance, when I lived in the neighbourhood of Sandhurst;—here *is a diagram of the country—and the diagram just below it shows* the relationship of Sandhurst on the one side to the neighbourhood of Wokingham on the other. Wokingham stands on a patch of sand above the clay called "London Clay." We had a servant who said she came from Wokingham. *After some time, she went for* a holiday, and came back with a very handsome bunch of celery, and said that her father had sent it from his garden for the Missis. I said, "Then you do not live at Wokingham?" "No, Sir, we do not live at Wokingham." "Why did you say you lived at Wokingham?" "Oh! we call it so, but it is more than a mile from Wokingham." I knew it was, and why? Because celery grows on clay, and the only clay about there is a mile or so from the town. The other day I had the pleasure of hearing Sir Charles Wilson speak on the subject of geology being valuable for military men, especially for our Engineers; and he spoke of an instance where a spy had been taken and brought before the Intelligence Department of the place, and a sharp eye saw that he had with him something that showed the kind of country that he came from. If I understood rightly, his legs had mud on them, and this indicated whence he had come; and they got from him the information they wanted. Mr. Topley's remarks on the new maps of the Geological Survey are very valuable. I am sorry we cannot spend a little more time about this subject to-day. There was a paper written lately by one of our geological colleagues, containing a statement that I could not help copying out, because it belonged to this matter; and, if you will allow me, I will refer to it. He was working in Bavaria amongst some particular igneous rocks—very difficult work. He states there was a dense fir forest clothing the whole of the slope, and preventing any very satisfactory evidence being obtained. "Here and there, however, a knob of rock rises above the soil of pine-needles, the path beside the stream shows an occasional low section, and the bed of the stream affords a little additional information as to the general nature of the diabase and its varieties." He traced it, however, up through this fir forest by little projecting masses, and by the small exposures in the riverside, until he completed his map and section. Somewhat similar instances occur with travellers. The Arctic explorer, McClintock, states that he often went across the desolate Montreal island with no other guide than a dyke, which kept in a straight line, and he followed it. If he did not know aught else of the country, he could trace that. He did not know the rock, microscopically, as to whether it was quartz or trap-rock: but he knew that it was a safe guide for him, and he used it all the time they were stopping there.

The CHAIRMAN: Gentlemen, as I am perfectly incompetent to criticize Professor Jones' lecture, I have allowed him to make his remarks before I rose myself. My scientific knowledge of geology is infinitesimally small. They certainly did not educate the Officers of the Army when I entered some fifty-five years ago as well as they do at the present time, and my scientific knowledge of geology is only sufficient to allow me to discriminate between chalk and cheese. I do not know whether you will allow cheese to be a geological formation, but I am quite sure you will all agree with me in tendering a very warm vote of thanks to Professor Jones for the lecture he has given us this afternoon. I can only say one of the greatest advantages we ever attain at this Institution, is when we can persuade gentlemen not of the two professions who support it, to come and give us lectures on subjects which are likely to enlighten us, and when gentlemen also in the same category are good enough to get up and speak to the subject. I, therefore, have to request that you will allow me to present a very warm vote of thanks to Professor Rupert Jones from all here present for the lecture he has given us, and also from those who have not spoken, to the gentlemen who have been good enough to rise and elucidate the lecture.

Friday, March 13, 1891.

GENERAL SIR ARTHUR J. HERBERT, K.C.B., in the Chair.

BATTALION COMMAND.

By Colonel M. GOSSET, C.B. (late Dorsetshire Regiment).

THE position of the Commanding Officer of a battalion is of such importance that I feel an apology is hardly needed for my appearance at this Institution this evening, to give you my ideas. Not that I can boast of having anything novel to lay before you, but having now been thirty-five years in the Service, and having lately given up the command of a battalion, I thought that my experience might be of use to those who aspire to command, and that I might, at any rate, open up some questions of import to our Army at the present time.

I may say, to begin with, that the command of a battalion is in these days a much more difficult task than of old, simply because so much more is demanded of all ranks than formerly. Ever since the Crimean War, we have been slowly and, I hope, surely, advancing in a knowledge of our profession, and we are gradually teaching our young Officers and men that soldiering means something more than a good march past and rigid movements on the barrack square. Not that I despise work in the drill ground, for it is a part of disciplinary training which should never be relinquished, and there is a danger that in our reforms this might be lost sight of.

I will begin with the private soldier. In these days of talk, and a Press that is always on the look-out for something out of which to frame a smart newspaper article, a great deal is said and written about Tommy Atkins, and many will say, and have said, that he is not the man he was.

My experience of him is that he is not the man he was—only in the sense that, as a rule, he is a boy—but, taking him all round, he is every bit as good in quality, and, if treated properly, better in conduct, than of old.

So many able military men have pointed out the danger of a boy army, and so many regimental Officers shake their heads when they read post-prandial speeches cracking up the efficiency of the Army in England and its readiness for service, that it is merely going over well-trodden ground to allude to it.

Leaving out the regiments in India, in the Mediterranean, and elsewhere out of the United Kingdom, there is not the slightest doubt

in my mind that the majority of our home battalions are quite unfit for war, simply because they are composed of boys.

They have not the service to have had ingrained into their natures the value of discipline; they have not the age and service to ensure their making the most effective use of their rifle in the excitement of action; nor have they the age or service to enable them to withstand the hardships of a campaign, and in a fortnight half of them would be in hospital. The causes are well known:—under-age enlistment, deferred pay, which tempts a man to go at the expiration of his first period of service, and the emasculation of the home battalion to feed the linked battalion abroad.

We Englishmen never seem to be able to hit off the happy mean in our reforms. Because the old soldier of twenty years or more ago, that is, the man of from eighteen to twenty-one years' service, was broken down, as a rule, we make a *volte-face* and put in his place a boy of sixteen or seventeen years of age.

I, of course, am fully sensible of the value of a Reserve, but I am at a loss to see why a man should not be enlisted for ten or twelve years, which would enable him to go to the Reserve at twenty-eight or thirty years of age. It appears to be the period of enlistment best suited to our voluntary Army, and would be of immense value in raising the service value of our battalions, and, we may also say, our Reserve.

But, boy or man, the material of our Army is excellent, and I have left my battalion—which, by the way, is now composed of men principally of an age between twenty-three and twenty-five years—with the highest opinion of the British soldier. I am happily spared the pain I should feel of seeing some 300 or 400 of them go bodily to the Reserve, and their place taken by boys.

I will now turn to how a soldier should be dealt with. So much nonsense has been written of late about the wrongs of soldiers, that the outside world likely enough regards him as the most ill-used man under the sun; that he is bullied by his Officers, done in the eye in the matter of pay, and that his life is a burden to him.

I quite allow that the question of how he should be treated with as a member of a free nation is a very important one. But those who write so glibly in the papers view the matter from a civilian standpoint, and have often not the most elementary ideas of what discipline means, and how important it is, if we want to retain our old reputation in the field, that it should be maintained. There is one thing of which I am very certain, that insubordination in the Army, wherever it exists, is not caused by severity, but by either a mistaken clemency, or else a want of discrimination as to the degree of an offence.

I have seen cases in which a man who cheeked a non-commissioned officer received the same punishment as one who over-stayed his pass an hour or so; and what has been the consequence? Insubordination increased, and had finally to be stamped out by the most drastic measures. You cannot rule 800 men with rose-water. A man should know beforehand what to expect if he commits certain offences, and it is this knowledge that either increases or diminishes crime.

But it is not by punishment alone that men can be ruled. It is necessary for those who are not alive to any milder sort of argument, and these form a small minority in a battalion, but it is by considering the sentimental side of men's natures, and this I do not think is sufficiently thought of in dealing with men, good characters or bad. For instance, when a particular class of crime is common in a battalion, the ordinary stereotyped way of proceeding is for the Commanding Officer to issue a regimental order, couched in something like the following terms:—

"The Commanding Officer having remarked that the crime of doing so-and-so has become very common, he warns the battalion that any man offending in this respect in future will be severely punished."

Now this is all very well, but it shows a want of knowledge of human nature. History proves that you cannot deter men from crime by threats. Arnold, of Rugby, recognized this, and so did not the authorities at Sandhurst when I was a Cadet. Smoking was in those days a heinous offence—drinking was so, more correctly. We were threatened with severe punishment, and a system of espionage was established to find us out. What happened? It was considered a fine thing to smoke and drink, and all our efforts were directed to evade the spies and to indulge ourselves with bad tobacco and worse liquor.

I am pretty certain that if the Governor had assembled the cadets and made it a point of honour for the good name of the College to forego these vicious habits, I, for one, should not have learnt to smoke at fourteen, and considered myself a very fine fellow to run three miles to a public-house for the purpose of drinking rum shrub.

And so it is with men; they should know what punishment an offence will certainly entail, but threats are bad, and return on those who issue them. My experience is, and I have never found it to fail, that by appealing to the better feelings of men by a few chosen words on parade the evil will stop. The speaker must, of course, be believed in and have the good will of the men. If he has not, he has no right to be in the position he holds.

Yet another point on the subject of punishment. A man is brought up for drunkenness or some other offence, bearing on his arm three or four good-conduct badges. I think I am right in saying that the general tendency among Commanding Officers is to be lenient to him because he is so decorated. They think it will be hard on him to take away a badge and injure him as he is leaving the Service. Now, I do not altogether agree with the Officer who looked upon a number of good-conduct badges as the result of a long and successful career of crime, but it is often the case that an old soldier, who knows the ropes, answers his name at tattoo and goes to bed full of drink down to the Plimsoll mark, sleeps it off, and is seldom hauled up. My idea on this question has always been that, if a man bears on his arm these honourable distinctions, he should be what he is supposed to be, and that, if not, he is a walking lie. I therefore often took away a badge from a man of this kind, telling him at the same time that good-conduct badges are a test of good conduct, and that, if he

did not choose to live up to them, I was at loss to see why I should deal differently with him than with any other man. He seldom saw it in the same light.

There is one more point in dealing with men, which is, I think, often too little thought of. Men, as a rule, are well abused if they do wrong and do not get enough credit when they do well. Soldiers, of all other men, are peculiarly susceptible in this respect, and, although the ordinary Englishman is no lover of butter applied too thickly, he is keenly sensitive to a few well-spoken words of praise. With Irish soldiers, who are more impressionable, and who have always been difficult to manage in quarters, and are such fine fellows in war, this feeling is accentuated. Prince Kraft in one of his books mentions the case of a battalion having failed in an attack, and who were, in consequence, broken in spirit and downhearted. Seeing this, a General Officer rode up and said, "Bravo! You could not have done better." The effect was magical.

It struck me years ago how little was done to make the men acquainted with the history of their regiment.

There is hardly a regiment in the Service that has not a glorious record to boast of, and some are exceptionally fortunate. The battalion I had the honour to command can boast of having fought at Plassey under Lord Clive, at the four years Siege of Gibraltar, in India, in the West Indies, and in the Peninsula, where they took part in the glorious soldiers' battle of Albuera.

To remedy this want as far as I could, I wrote out and delivered a series of lectures, taking in the whole regimental history, illustrating the principal actions on the wall of a fives court, and showing what part the regiment took in them.

If enthusiasm is a measure of success, these lectures fulfilled their object, and by enforcing that the honour gained in so many wars could not have been attained without good discipline, self-denial, ready obedience, and pluck, I do not think I am wrong in saying that the knowledge gained by the men of their regimental history raised their tone, and I could afterwards observe a steady advance in good conduct.

I would commend this to Commanding Officers. There is always some Officer in a battalion capable of giving lectures of this sort, and, as an appeal to the higher feelings, they are most valuable. In fact, I would recommend for consideration whether it would not be for the general good of the Service that the regimental history should form part of the instruction of every recruit.

It is not necessary to remind you of the improvement that has taken place in the soldier's condition of late years. His barracks, his food, his health, his amusements, all have been carefully considered, and if he is not a happy man he ought to be. The danger appears to me that we may coddle him too much, and that Jeshurun may some day wax fat and kick. With all his good qualities, Tommy in peace-time is a very helpless and careless man as regards his own good, and has in many cases to be treated like a child. He comes of a thriftless class, and, while he accepts everything that is done for him, he does

but very little for himself. Take the important question of cooking, or even the quality of his rations. The majority of the men show a supreme indifference to the whole question, and take what is given them and say nothing, and it is only by constant supervision on the part of the Commanding Officer that the cooking is improved, and that the soldier is taught that it is an advantage to have meals well cooked and served.

As regards drink, the character of the nation must change before we can expect it to disappear from the Army. It is not more common in the Army than among the class from which a large proportion of our men are drawn, but a man in a red coat is more *en évidence* than a civilian when labouring under the effects of liquor.

A man was brought before me one day for drunkenness, and he argued that it was impossible that he could have been drunk, as he had only taken five pints.

But drunkenness has decreased in the Army, at least as far as my experience goes, and there is no doubt the graver forms of it can be kept in check, such as drunkenness on duty, on the line of march, &c. I always, as a rule, punished a man more heavily for being drunk in town than in quarters, for the reason that in town he was disgracing his regiment. As many Officers know, it is not an uncommon thing when a battalion is changing quarters for the men to take a glass, as they call it, with their chums who are being left behind, and the result is scenes at a railway station highly discreditable. I have always found that an appeal to the men on parade, a day or two before the move, has been quite sufficient to stop this; and, as a proof of confidence in the men, have left the canteen open till the last, and the result has been that the worst characters have kept sober. I remember in India on an occasion of this sort, when a Captain, addressing a notorious toper, praised his sobriety. "Lor, sir," was his jubilant remark, "I havn't been so sober for years!"

So much as regards the private soldier. I now move a step higher, and deal with the non-commissioned officers.

The conduct of the non-commissioned officers and the way they do their duty depend entirely upon the Commanding Officer and Officers commanding companies; in short, on the system of the battalion. Raise the tone of the non-commissioned officers in every way you can, show that you do not intend to have one law for them and another for the private, and at the same time back them up, so that they are not lowered in the eyes of those under them, and everything will generally go straight enough. The complaint, nowadays, is that the non-commissioned officers are very young, too young to properly control young soldiers just joined, and who have not fallen into the restraints of discipline. This is unavoidable, of course, as long as our present terms of enlistment remain as they are, and applies especially to the young battalions at home. Abroad, the non-commissioned officers have, as a rule, more service, and there is not so much to complain of under that head; at least I can speak from experience with my old battalion, and taking them all round we had a good and intelligent lot of sergeants and corporals. There is one

thing with reference to non-commissioned officers which I think is worth thinking about, and that is the question of marriage. Nowadays, no private soldier or corporal can marry under seven years' service, a wise rule enough considering the age of the men, and the result is there are but few married privates in a battalion. This, I may mention, is a drawback with reference to the washing of men's clothes, which has now often to be farmed out. But this is a minor disadvantage; what I wish to point out is that a large proportion of sergeants can marry, and this has its effect on discipline—I mean barrack-room discipline; and the keeping of order in the barrack-room (and discipline begins there) is often left to young corporals and lance-corporals who are afraid to exercise their authority, the danger being, that irregularities are liable to be winked at.

With battalions of young soldiers this is a serious question, and I think it worth the consideration of the authorities whether the regulations as to the marriage of sergeants should not be amended. I am not one of those who run down the non-commissioned officers of the present day. They are better educated than those of former days, and it depends in a great measure what the system of the battalion is whether they turn out well or not. Those who complain of them most probably think that as soon as they get the lance stripe they will educate themselves, and are astonished that they are not like ready-made clothes, fit for work at once.

As regards the Officers, I see but little change in the class of gentlemen who join now from those of old days. Young Officers who join are generally quite ready to learn, and it depends entirely on the Commanding Officer whether they are properly taught or not. There is no doubt, if they are not made and encouraged to study, several of them will let it slide. And this is quite natural. Officers are well received wherever they go—they have every incitement unless properly controlled to make their duty subservient to their pleasures, and it is very much to the credit of our Officers that they have, as a rule, a strong sense of duty. The manner in which this sense is fostered and applied depends on the Commanding Officer and on the Captains of companies.

In old days, as all men of any service will well remember, the whole business of a regiment was in the hands of the Commanding Officer and the Adjutant—the Captains were nowhere. They had no encouragement to act on their own responsibility, and the consequence was that they looked to the Commanding Officer for everything. Some men are so constituted that they will accept responsibility in all circumstances, but many are not, and I am certain that if a Commanding Officer wants his battalion to be in good order, he must insist on everyone doing his own work and not look to anyone else to do it for him. A Commanding Officer's and Adjutant's battalion is bad. A Commanding Officer should not be like the Minister in the "Mikado," a man holding a plurality of offices, but should act on the principle of "Divide and govern."

I have always regarded this principle of decentralization as one of the most important questions relating to command, and in carrying

it out have found that Captains of companies soon learn to take a higher view of their duties, and by accepting responsibility themselves have exacted a proper share from those under them. There is no doubt that Officers not so trained are apt when they get command of a battalion to be always referring questions to the General in command which they ought to settle themselves, and there is often a tendency among General Officers to encourage this instead of refusing to interfere. The same may be said with reference to work in the field. If enough latitude is not given to Officers commanding companies, and they are always interfered with, they won't act independently, and I have seen many a well-conceived little manœuvre fall through from want of initiative on the part of junior Officers; and who has not seen a Commanding Officer make his battalion look foolish by want of this sense of responsibility and an appreciation of the situation on a field day?

I hope I may be excused criticizing Officers of a rank higher than my own, but the fault in our regimental training of a Commanding Officer vesting everything in himself, and not giving enough responsibility to subordinates, has often been the cause of undue interference with battalions both in quarters and the field—with the result that a sensitive Commanding Officer is apt to be in a perpetual state of irritation, and a nervous one to tremble when he sees a cocked hat, and to be almost servile to an A.D.C.

The regulations of late years as to company training, musketry, &c., all tend to train all ranks to accepting responsibility with good results, but I fear there are still some Commanding Officers who cannot resist the temptation of trying to do everything themselves. They may have their battalion in capital order, but they do not leave enough behind them, and there is always a danger of the whole fabric falling to pieces.

At the same time, the Commanding Officer of a battalion is the life and soul of it—he must have his eye on everything, know everyone's wants, and never imagine, because he has established a good system, that it will keep going without a perpetual greasing of the wheels. I excused myself some time ago from attending some entertainment, by saying I had work to do; a lady at once said, "A Commanding Officer has nothing to do: he has only to issue orders." This is the popular idea, no doubt, and it is as easy to issue an order as it is to write out a cheque; but it may not always be cashed. Our friend Mr. Pecksniff remarked: "If England expects every man to do his duty, she is very much mistaken;" and he showed his knowledge of mankind. There is always somebody who wants gentle persuasion or otherwise to do his duty, and orders, however sensible, often fall through from want of the supervision necessary to have them properly carried out. I think it was Lieutenant May, of the German Army, writing of the War of 1870–71, who pointed out that the men composing an attacking force were to be divided into three classes. The first class were the bravest and best—who led the way; the second those that only wanted a lead to go on; and the third those who had always an eye over their shoulder with a view to going back. So it

is in the matter of duty, and it is the third category who have to be spurred on.

Having dealt generally with the various ranks that make up a battalion, I will go on to the important subject of education. After I began to write this paper, I came across a lecture delivered in this Institution last year by Major Ker Fox, on the Training of Cavalry; and in the discussion that followed, General Sir Charles Shute, who presided, alluded in forcible terms to the system in our Army of detaching Officers from their battalions for acquiring knowledge.

I do not myself see how this is to be entirely avoided until we have advanced considerably in knowledge; but I have long been of opinion that the regiment or battalion should be the school of instruction for all ranks. I do not mean to say that every Commanding Officer or every Captain is capable of becoming a good instructor; but there is generally in a battalion some Officer who has the knowledge and aptitude for the work: and anyone who has instructed Officers or men will tell you that he himself learns as he instructs. If we want to make a real advance, the battalion must become its own school, and the schooling should be gradual from the time an Officer or man enters the Service. There may be some who think that the time has not arrived for this reform. Judging from my own experience I think it has, and I should hail with pleasure when the order is issued to do away with garrison instructions and adopt regimental instruction in their place. It is a melancholy thought, that in order to enable an Officer to pass for promotion to a higher grade it should be necessary to detach him from his battalion to go through a system of cram. I know of nothing more calculated to disgust an Officer with subjects with which he should be well acquainted. Nowadays, many Officers commanding battalions are S.C. men, and could easily direct the instruction of all ranks theoretically and practically.

There are, of course, great drawbacks in the matter of practical instruction in tactics, &c., in hot climates during a considerable portion of the year; but we might carry out a great deal more instruction, and more particularly of the Officers and non-commissioned officers, than we do now.

I would commend to the notice of Commanding Officers the interchangeable war-game maps of Lieutenant Sharpe, 3rd Middlesex R.V. I had them in use for three years, and, during the summer months in Malta and Egypt, worked out small schemes, which brought in map-reading, the issue of orders, the working of reconnoitring and strong patrols, and outpost work. Both Officers and non-commissioned officers took much interest in these schemes, and no doubt a good deal of knowledge was gained; while, as a preparation for the annual company training, it is useful.

As regards non-commissioned officers, the more you can educate them in the practical part of their profession the better: and that this is recognized is shown by the recent orders as regards their examination for promotion, and placing the preparations for these examinations in the hands of the Captains. This and the company training,

honestly and intelligently carried out, ought to advance them considerably in knowledge. The tendency is for non-commissioned officers (as also in the case of Officers) to get a parrot-like knowledge of the book, and to be utterly abroad in the field. Many of them, when lance-corporals, show great intelligence; but often promotion seems to dwarf their intellect. Whether this is the result of the narrowing tendency of barrack routine I do not know: but it is the case, and I have often been surprised by the utter absence of "nous" and intelligence (on the ground) shown by good men. Company training has done a great deal to improve our non-commissioned officers, and, as time goes on, we shall get much better work out of them.

As regards the annual training of companies, I latterly had two companies training at the same time, in order that a good deal of the tactical work could be carried out with opposing forces under some special idea, and so made as like as possible to what would really happen on service. The varied ground round Cairo is particularly suited for minor tactics, and much interest was shown by all ranks in the work, simply because they had very little to imagine.

To tell Tommy Atkins that a certain position is occupied by an enemy when it is not, conveys but little to his mind; but let him see some helmets showing over a trench, or a wreath of smoke, and the report of a rifle, and he realizes the situation at once. It, of course, depends on the quarter a battalion happens to be in whether there are facilities for practical tactics; but I know from experience that, if a Commanding Officer will take the trouble to visit the farmers in England, they will, as a rule, allow troops to manœuvre over their land, and will turn out with their families to see.

With regard to the private soldiers, I may be thought somewhat of a heretic when I say that the tendency nowadays is not to teach him too little, but too much; or rather, I might say, that we are apt to lose sight of certain essentials which make the good service soldier, while we stuff him with a good deal that may well be left alone.

No one is more convinced of the value of the annual training of men by their own Officers than I am, and I have always taken a great interest in it, and have striven to make it as practical as possible; but, as far as the private is concerned, I would use the shears and cut down a good deal of it. Four weeks is too long to keep men at instruction, they weary of it; and, moreover, it is only in England where we can afford to give so much time. In hot climates, where all the practical instruction of a battalion has to be carried out during a period of six months or less, the course has to be curtailed, and I have found that fourteen days of good, steady, practical work is very nearly, if not quite, enough for a company.

The Queen's Regulations lay down that, when practicable, infantry should go through a short course of instruction in field works, which includes modelling, indoor tracing, making siege parallels, field redoubts, &c. It is impossible to give Tommy Atkins anything but the most rudimentary knowledge of all this; and it has often made me sad to see him patting the superior slope of a model fort which has been traced out and made without any governing tactical idea,

and in a position where no one on service would place a fort. Teach Officers and non-commissioned officers how to do these things, if you like, but let Tommy Atkins be taught simply how to dig without breaking the handles of his pick and shovel.

I have said above that we are apt to lose sight of certain essentials in our strivings to make Tommy a Jack-of-all-trades. These essentials are—1st. Discipline. 2nd. The power of marching long distances well. 3rd. The power of shooting well.

1. No military man requires to be reminded of the value of discipline. It is the first thing and everything, for without it you can do nothing. I have already alluded to it, and I would add that it can be fostered best by inculcating a feeling of honour throughout every rank, and a sentiment that it is the duty of every individual to strive to maintain the good name of the corps.

2. *As regards marching.* Good marching means that men are able to stand hard work, and get alongside an enemy in good form.

Our physical training has always, as a rule, tended more to strengthen a man's arms than his legs, whereas the latter are more important of the two, for it is the soldier's power of movement that is everything in war. This power is not to be gained by a route march once a week. As far as my experience goes, the only way to attain it is to have running drill extending over some months. During my command, I had running drill every morning for three or four months in the winter, beginning with short distances, until the men could get over 1,000 or 1,200 yards, carrying their rifles without distress. It is the only way to make men march well, and also to make their boots easy. A man's boot gets into shape in the action of running, and if they are kept soft by dubbing—a pot of which I made part of the soldier's kit—they can do anything. In Egypt, where we had long field days in the desert, some miles from the barracks, I found that the men could do a long day's work, and come home singing at the end at a swinging pace.

As regards the third attainment, "shooting," a great deal has been written and said. Good shooting at a target is not difficult to attain, and it steadily improves as the men grow older. All that is wanted is that all ranks, beginning with the Commanding Officer, should take the interest in it that so important a part of a soldier's training deserves. When once the spirit is infused into a battalion, every man does his best, and the older the soldier the better he shoots, as a rule, provided he does not suffer from any visual defect. This is an argument in favour of older soldiers. Ask Officers who have commanded companies of young men during some of our small wars, and they will tell you of many cases of wild and useless firing. Instruction in the use of the rifle should not cease with the annual course, but should always be going on. I made it a rule never to have a battalion parade without firing volleys by sections, always directing the aim at some point, generally oblique to the front of the line. As a lesson in fire discipline, and in teaching Officers and non-commissioned officers to give good words of command, and to attend to the adjustment of the sights, &c., it was very useful, and the result was

that, even if the individual firing during the annual course was not so good as it might have been, the volley firing, both ordinary and rapid, was very good.

I do not think the practice of volley firing on parade can be carried too far, as it accustoms the hand and eye to work together, and in war-time men so trained would probably wait for the word of command from pure habit; and, with very young soldiers such as compose so many of our battalions, the exercise is absolutely necessary.

There is one question with reference to individual shooting which might, in my opinion, well be seriously considered. It is, that every company has a few men who, either from defective sight, stupidity, or any other cause, remain 3rd-class shots all their service. Notwithstanding this they go through the same course as the rest of the company. If a man cannot make a decent score up to 400 yards, it seems absurd to allow him to fire at the longer distances. He should be made to fire at the short distances until he gains something like a decent score.

A 3rd-class shot is an ineffective soldier, and one very good regulation is not to allow men of this class to hold any position such as an Officer's servant, mess waiter, canteen waiter, &c., or to be put on any other regiment or garrison employ, until they get out of the 3rd class. I found it had the effect of making bad shots take pains and improve, simply because they got extra parades, and their comrades ridiculed them. It also gave marksmen and 1st-class shots a higher sense of their position in the battalion.

I think also that we do not, as a rule, consider sufficiently the value of the field practices. They are the test of what a company is worth individually and collectively, and I should like to see more stress laid on their importance.

As regards battalions making very high scores in the individual practices, I am a sceptic. There is likely to be a tendency to maintain the position of being a good shooting battalion by hook or by crook. I do not know which are the battalions on the top of the list, so I am not casting any aspersions, but I am sure, in my own mind, that while it is possible for a battalion of old soldiers to hold a high place, it is not possible for them to retain it when 200 or 300 of them go to the Reserve, and their place is filled by boys. It can be regained of course if the instruction and the spirit of the men is good, but only gradually.

With the introduction of the new rifle, our shooting ought to improve, for there is no doubt that one cause of bad shooting with the Martini-Henry is the kick.

I have seen men at bathing parades with their shoulders black and blue, and there are many men who have to put a pad to their shoulders to obviate it. It will be said that this is the result of bad position in firing. I do not think so; for I know many first-rate shots, Officers and men, who suffer in this way. It depends on their build.

I have often thought that, supposing you gave a man 100 rounds before starting to attack a position, he would hardly be able to put

the Henry-Martini to his shoulder at all when he reached the effective distances, and when independent firing began, would most likely fire from his hip.

As a rider to the question of the instruction of men, I would mention that last summer I found myself in a railway carriage with a serjeant, and, in answer to certain questions I put to him with reference to the recruiting of his battalion, he said, "Our three-years men are now so bothered with drill, training, and perpetual work that it has the worst effect upon recruiting. They long for the day when they can take their discharge, and they go to their villages carrying with them a feeling of disgust for the Service."

This shows that with our voluntary Army, particularly with men who enlist for so short a term as three years, we may debar men from joining the ranks from *trop de zêle*.

It was Sir Cornewall Lewis who said that men in these days do a great deal too much, and I think the tendency is, with regard to the private, to try and grow corn on uncultured ground. Educate the Officers and non-commissioned officers as high as you can, especially at a time when their minds are most receptive, but go judiciously with Tommy, who is apt to ask why he is being humbugged about, and to resent it.

In bringing what I have to say to a conclusion, I should like to add one or two general remarks.

In the first place, I would say that, while our Army has made great strides in many ways, I, as a regimental Officer, have never been able thoroughly to fall in with some of the changes in the last two decades. The old regimental system had its faults, and as a matter of policy with reference to recruiting, the linking of battalions may have been necessary, but it has its bad side in creating a feeling of unrest, and in loosening the old ties of *camaraderie* that existed in old days between Officers and men. This has been increased by the short service system, by the frequent changes among Officers caused by transfer on promotion, by the method of officering the Indian Staff Corps, &c. In fact, in our Service we are always robbing Peter to pay Paul. I do not say that in such a complex system as ours it is to be altogether avoided, but the perpetual change that goes on affects the Army injuriously, and, moreover, touches up the pocket of the taxpayer.

The only advantage it seems to me to possess is that it infuses new blood in a battalion, and even that is not always wanted. I hope the day is not far distant when regimental numbers will be restored. It requires a man of more than ordinary intellect to remember the long titles now in use, and for war they are absolutely impracticable. I believe the clerks in the War Office have still, after ten years, to put the old numbers opposite the titles in their books, in order to avoid mistakes, and as for the outside world, titles are all vanity and vexation of spirit.

Another reform I should hail with pleasure is that when an Officer has completed his period of Staff service, the regulation with reference to his going back to regimental work should be rigidly

enforced. Nothing does a battalion more good, if he is a good soldier, and does not look on regimental work as *infra dig.*, and as regards himself, he learns an immense deal which is of the greatest use to him and the Army when he reverts again to Staff duties. Officers who pass the greater part of their service on the Staff lose their touch with the soldier, do not know what he is capable of, and when they get to high commands may have to learn at his expense. I would also suggest that Officers who go to the Staff College should be seconded, and when they have finished their courses should always return to regimental life for a season as supernumeraries. Without it they cannot keep abreast of the work. It would be of advantage to them, and, as regards a battalion, it is hard to deprive it in these days of such an important Officer as a Captain for $2\frac{1}{2}$ years without filling up his place.

I am conscious that there is much that I have stated which is already met by the regulations of the Service, and have been dealt with by abler men than myself. All I hope is that the practical experience of a Commanding Officer in carrying out the regulations may be of some value.

Lieutenant-Colonel De Bernière (Worcester Regiment): It is with some diffidence I speak on this subject, but having had the honour of commanding a battalion now for some eighteen months, I should like to thank the lecturer very much for his most interesting and very instructive lecture. I agree entirely with what he has said with respect to the discipline of a battalion; particularly with regard to the punishment of the men, so that when an offender comes before his Commanding Officer he may almost be able to punish himself, that is to say, he knows exactly how his particular offence is invariably dealt with. Again, as to good-conduct men, I always try to impress on my men, that an offender coming before me, and bearing on his arm a good-conduct badge, must not think for a moment that he can trade on his record, or that he can possibly expect to be let off because he has it. I think the men thoroughly understand now that good-conduct badges should mean influence and example in the battalion. I must say that I should like to have my recruits sent to me straight on enlistment. Brigade depôts are valuable as recruiting centres, but the recruit should come at once to his future Commanding Officer to be improved physically and trained professionally. I try to get my men well seasoned after I receive them; to feed them well, work them well, and teach them the use of their limbs. As one means to this end, I have started a coffee shop in my barracks, and I have found it a most useful institution, insomuch that the young soldier feels contented and comfortable when he finds in his barracks what formerly could only be got outside. To accomplish this end also, there is a credit system, and a man can have a pint of beer with his supper, if he so wishes. The Commander of the Forces in Ireland, visiting us at Limerick last November, expressed approval of the coffee shop arrangements. With regard to non-commissioned officers, I must say I am satisfied with mine. Besides my sergeants' mess I have a corporals' room, which I find answers very well indeed—*not a corporals' mess*, but simply a room. It gives the corporals a status and position in the regiment; they, of course, dine in the barrack room, but this gives them a room for themselves where they can read and work. The lecturer spoke of the chain of responsibility, the responsibility not being on one man's shoulders, but going through the battalions from the top to the bottom; each one knowing that, whatever department or show he has to run, he is entirely responsible for it to the Commanding Officer. I am sure we shall all admit that this inculcates self-reliance, judgment, and common sense; and junior Officers are thus daily being trained for command, by acting independently, and not referring every single thing. Again, as to the manœuvres that the lecturer spoke about and the civility

of farmers, I must say that the farmers in our part of the country round Limerick are, as a rule, most considerate. We always go out once a week, cavalry, artillery, and infantry, and have some tactical exercises. The farmers are very civil and allow us to go over their ground, and manœuvre about in every possible way. These manœuvres are everything for the men; they improve their individual intelligence, and keenness and interest are plain all round. Young soldiers go out at eight, or half-past, come back at two or three, and not a man falls out, for the interest carries them through, the interest which would be wanting in the ordinary route march. I always try to impress upon every one that, from the Commanding Officer to the youngest recruit and smallest drummer boy, where all meet on one platform, each one is feeling that on *me* depends the good name, the practical efficiency, and smartness of the battalion. This fully realized all round, then you have the *ideal* regiment.

Lieut.-Colonel W. T. Dooner (Rl. Inniskilling Fus.): Mr. Chairman, ladies and gentlemen, I only rise to say how thoroughly I agree with almost everything that Colonel Gosset has said in his very excellent lecture. I think there cannot be two opinions as to whether it is better to try and rule men by appealing to their sentiments; by speaking to them of their country, their patriotism, their regiment, call it what you will, than to endeavour to rule them by either threats or punishment. I quite agree with what Colonel Gosset has said on that point. I fear the regulated time allotted to each speaker would run out if I were to mention all the subjects which he has alluded to and on which we are all probably of one opinion; I will, therefore, go at once to one or two little points, not for a moment to differ with him, but to mention that, as he has commanded a battalion abroad, and as I have the honour of commanding a battalion at home, all the suggestions he has made are not sometimes practicable on home service. Take, for instance, what has been said with regard to garrison instruction and doing away with it. I quite agree with what Colonel Gosset has said, but let me tell you what my experience was. I started a system of instruction the moment I could, in order to prevent, if possible, the Officers of my battalion having to go away to those classes of instruction, and also because I quite agree with the lecturer that it is more or less a reflection on Commanding Officers if those under them have to go elsewhere to learn their profession. I therefore started classes twice a week, and my hope was that I should have been able to make the whole of the Officers go up for examination together; I found, however, after I had got through one subject with the greatest difficulty, that I had to give up my idea in despair. The Officers that I could catch one day I could not catch the next. What with District Court-Martials, with boards, and all garrison duties that they had to perform, they were taken away from my instruction, and I was going over and over the subject, and at last I had to give it up. There is also another point with regard to that garrison instruction which should be mentioned; I think it would be, perhaps, a little hard to expect everyone, I mean all Commanding Officers, to be quite prepared to answer all the questions which are given, until the examinations become a little more practical. For instance, an Officer rushed into me some time ago after an examination had taken place, saying, "Oh, tell me, have I made a mistake in this question?" The question was to draw the scale of a kilometre to a decimetre. Now, I think there is no use when you come to think of it, in asking any Officer such as question as that: because, when could they ever possibly be required to draw the scale of a kilometre to a decimetre? We know the French, when they make a map or plan, always put the representative fraction on it, and that question was put, I fear, in order, more or less, to make the Officers in the hurry of an examination get nervous and bewildered. In another examination, the question was asked, "Comparative to one inch to a mile, draw a scale of Russian versts." Now, if the Crimea were to come over again, of course we all know we would try and get maps of the country we were fighting in, in every possible way; we would go into the first houses we came to until we succeeded in getting one; and having got it, we know perfectly well, in the country in question maps will not have their scales expressed in that peculiar way; they will have the representative fraction given; I only mention those two questions which occur to me just to show the lecturer that there are considerable difficulties in attempting to carry out all the instructions that would be necessary

to enable Officers to pass their examinations. There is one thing Colonel Gosset states in which I differ a little, and I rejoice that I get the opportunity here of mentioning it. He says that Irishmen are very impressionable. I quite agree with him that they are; but then, when he says that they are always more difficult to manage in quarters than other people, in my opinion there is a mistake there; I know it is the opinion all through the Army, but I think there is a little error in it. An Irishman, take him on the points that the lecturer mentions, his country or his regiment, &c., and there is no man more ready or more willing to keep up the credit of both; that is what my experience has been. I find what Colonel Gosset says, namely, mentioning on parade a few things like that has a most wonderful effect; and as for severity of punishment and threats, except in the worst cases, as Colonel Gosset says, they are better avoided. There is one subject that has not been dealt with by the lecturer, viz., the question of bad characters, and what is best to do with them. I think that Commanding Officers, and I hope there are many such Officers here, ought to make up their minds that they will not discharge any man as either incorrigible or worthless, or with disgrace, I may call it, unless there is some very serious cause for so doing. I think that by discharging these men we only pass them on to other regiments. The State will not allow us to mark the men in any way, so as to prevent their re-enlisting; and I think if all Commanding Officers were to make up their minds that they would not discharge any of these men, if they had the bad luck to get one or two, until the men in question had at least served five or six years, and, therefore, would not be able to enlist again, it would be very advantageous: because any approving Officer, when a man has had five or six years' service, will probably be able to spot him as having previously served in the Army. If he is a young fellow who has previously served who tries to enlist, these men come in such a way, dressed in old clothes, and they imitate civilians of that class of life so well, that I myself, having enlisted hundreds of men in the last two years, know of two cases in which I have been taken in, that is, that the men had served before. I take the greatest trouble, but still I have been done in that way; it is most difficult to be certain on this point of men having previously served. At Portsmouth there is a custom that we Commanding Officers have to take what they call the details for three months in turn, and so the recruits enlisted for all the regiments round about pass through our hands during the time mentioned. I therefore have had some little experience of this question of enlistment, and I know that in two cases, probably there were more, I have been, so to speak, done by these bad characters. Every ship that comes home from India brings some eighteen or twenty of these men. They are brought up suddenly into your guard room, and they are all then turned adrift into this country to do the greatest harm to the Service, and also to find themselves, I fear, shortly afterwards in some regiment. I therefore think that if we did not discharge these men until they were a little older and have more deferred pay to lose, it would be better. With regard to what Colonel Gosset said about the military training, there cannot, I think, be two opinions. It is a great deal too long, and the annoying part of it is that actually the Commanding Officer is not considered, I suppose, capable or able to instruct his regiment, and he has the pleasure of seeing his companies going out, and almost losing in some cases four weeks of their valuable time—the summer is not very long—two companies are taken away from him the whole summer, one for musketry, and one for this military training. If you take the state of any regiment and investigate it, you will find a Commanding Officer is not then left with more than 100 or 120 men for the duties; and thus I go on parade, and have to content myself with drilling some four companies of perhaps fourteen or fifteen files in single rank. I hope that point that the lecturer has brought to our notice will be well thought about and considered by those in authority, because I quite agree with him that the men do not like it. They tire of it, they do not care for being what they call "humbugged about," and it is a little hard on the Commanding Officers. I do not know whether Colonel Gosset found it so in Egypt, and whether he was able to get more men in his battalion than I am, but the consequence of the present regulation is, that the men are taken away from us during the whole summer, and the Commanding Officer is unable to carry out much valuable instruction and work that he would perhaps wish to inaugurate and accomplish.

Colonel M. GOSSET, C.B.: With reference to the remarks made by Colonel De Berniere and Colonel Dooner, it is a great pleasure to me to find that they agree with me in the main points in my paper. There are one or two questions which they have alluded to which I think are important. Colonel De Berniere spoke about the corporals' room. Two or three years ago there was an order issued to establish corporals' messes, which meant to say that you took the corporals away from the barrack rooms for their meals. I, for one, opposed that strongly, because you want men of authority in the barrack rooms. The sergeants' mess naturally takes the sergeants away, and if you have a corporals' mess, which includes lance-corporals, the men's rooms are left entirely without anybody of any position to overlook them. I do not think we have reached that advanced stage of culture which will allow us to deprive the barrack rooms of the corporals. But a corporals' room, if properly carried out, raises the status of the corporal and gives him a more elevated idea of his position. My object was to prevent the corporals and men drinking together, and I made my corporals' room as comfortable as I possibly could. They had their music and dance meetings, &c., and it is no doubt a very excellent institution in a battalion. There is a great deal, I quite allow, in what Colonel Dooner said as to my idea of doing away with garrison instruction. That is a question which I, of course, judge according to what I have seen in my own surroundings, and, having been abroad some time, I may not be able to deal with the matter from every point of view, but, judging from my own corps and from what I have seen, I think that by gradually instructing the Officers as they join and establishing a school in the regiment, the necessary instruction which would enable an Officer to pass for his promotion may be got through. I have not said so in my lecture, but what I really had in my mind was that, when musketry assumed such an important position in the British Army as it did after the Crimean War, musketry instructors were appointed. After a time, it was found that they could be done away with, and they very properly were done away with. Now, I think if it is not found that you can instruct the regiment at present (and I think it is quite possible you could not, for the reasons given by Colonel Dooner), in the way which I should like to see done—why not have a regimental instructor just in the same way as you had the old musketry instructor? As I say, a man learns as he instructs, and it would not be a very costly appointment. I do think that you might prepare Officers for their examination in the battalion. The regimental instructor would be under the Commanding Officer and controlled by him, and under well-considered regulations, I think it would be a decided advantage. I confess, myself, I could not answer a good many of the examination questions that are put to Officers who have gone through a course of garrison instruction, and if they brought to me such conundrums as they did to Colonel Dooner—I am glad to say that nobody ever consulted me to that extent—I should have shied at them as he did. Colonel Dooner has the honour of being an Irishman, and, therefore, I hope he has not taken any offence at the remarks that I have made about his countrymen. But I always had an idea from seeing Irish regiments that they are very impressionable and very much open to sentiment, and, as a rule, difficult to manage in quarters. I think it is the very impressionability which makes the difficulty, and what I wanted to point out is that they are more open to a good word than anybody else. The fault an Englishman often commits when he is commanding Irishmen is that he is too downright with them, and does not take sufficiently into account the sentimental side of their nature. One important question has been raised as to the discharge of bad characters, and I must say I do not agree with Colonel Dooner in what he has said on the subject. For many years, as most of us who are old soldiers remember, the Horse Guards fought against discharging men of bad character with ignominy, and the reason given was that it was encouraging men to behave badly in order to get out of the Service. There is a good deal in that argument, but I must say the change that has come over us of late years, in allowing an Officer commanding a battalion to recommend bad characters to be discharged, is a good move; I always exercised it to the full, and believed in it thoroughly. Colonel Dooner's argument appears to be this, that the men merely go out of one regiment to get into another. I daresay he is perfectly right in some cases He suggests that they should remain five or six years in the regiment, and

that there would then be less chance of their re-enlisting. Now, what is the use of allowing a man of excessively bad character to exert a bad influence in a battalion, amongst a lot of boys, for five or six years?

Colonel DOONER: I did not refer to men of excessively bad character.

Colonel GOSSET: I cannot help thinking the rule now is a good one, and I should be very sorry to see it curtailed in any way. I think it should be left to the Commanding Officer entirely to judge the question himself. Without doubt it is a bad thing for the young men who join to have alongside them scoundrels who will never make good soldiers and who spend the best part of their service as defaulters or in prison. It is better to get rid of them and have done with them altogether.

The CHAIRMAN: Gentlemen, I think that I have seldom heard a lecture with which I could find so little to cavil. There is scarcely a sentence with which I do not agree. In fact, amongst those who have spoken, there are only some very trifling differences of opinion. The points referred to are discharges with ignominy; the Irish; and garrison classes. Now, with regard to Irishmen, Englishmen, and Scotchmen, there is no doubt that they require to be treated in different ways. I remember, many years ago, when I was a young man, my Commanding Officer instructing me in my duties, when I was going on detachment, said, "Treat men of various nationalities in different ways. Let an Irishman talk as much as he likes, let him stand up before you, and say whatever he likes, then give him his punishment, and he will say, 'Thank your honour.' With a Scotchman, give him the law; read to him the Articles of War, the regulations, and he will be perfectly satisfied. With an Englishman, on the contrary, give him his punishment and say nothing." That was the advice which was given to me, and it was one which I followed, and I found it, generally speaking, successful. With regard to discharges with ignominy, I agree with Colonel Gosset that it is a great pity to keep a bad character in a regiment; he is sure to corrupt the young soldiers and lead them astray. If you turn him out, he may enlist in another regiment, and they will soon find him out, and get rid of him. Men do not now like being turned out of a regiment, as they lose their deferred pay. In former days, when the authorities made great objections to men being turned out of regiments, they did not lose any pay, and they did not mind it. Therefore, I think the authorities are quite right in authorizing the Commanding Officers to get rid of bad characters; in fact, I would let them turn out any man whom they could not manage. With regard to garrison classes, I think a modified scheme might be brought about, so as to avoid so many Officers being absent at garrison classes. If there were a Board of Commanding Officers assembled in a garrison, and they set the questions to the candidates, the Officers could be educated in their regiments; but if the questions be set by persons who have not always practical knowledge, the questions become too theoretical, and to be able to answer correctly, Officers must attend garrison classes. There is one point on which I do not agree with Colonel Gosset, but on this point the majority of the audience was evidently quite in accord with the lecturer, as directly he said, "Let us return to our old numbers," everyone applauded. Will any one get up and be good enough to state how it is to be done? Regiments were linked, they were joined together; one was called the 52nd, the other the 43rd. Was a man to change his number every time he changed his battalion; was a man, when he is transferred, to change his uniform as he did formerly? I was on the Committee that recommended the change, and though I disliked it uncommonly, still as long as linked regiments continued, as long as the same principle of organization which existed was maintained, I do not see how the change could be avoided. It has been proposed, and in my opinion the plan would answer, *e.g.*, to re-number the regiments, giving both battalions the numbers of the regimental depôts. That would simplify the question, but I am afraid that would not be popular, because, for instance, battalions whose numbers were changed would grumble, the 52nd would not like to be called the 2nd Batt. 43rd.

Colonel DOONER: I believe there would be very few objections.

Colonel GOSSET: My idea was that you should not revert to your old numbers, but that it should be the Brigade Depôt number. From a practical point of view you would want a number in place of a title.

The CHAIRMAN: In that I perfectly agree. I know the difficulty of long titles. Now, gentlemen, I think you will all agree with me in thanking Colonel Gosset for the most instructive and most interesting lecture that I have heard for a long time. It is practical to the end, and there is scarcely a sentence in it with which anyone can disagree. I beg to return Colonel Gosset our very best thanks.

General Lord CHELMSFORD, G.C B.: Will you allow me a few words, to say how very much I regret that I was prevented by public business from presiding on this occasion? My feelings are very much relieved by finding that my place has been so much better taken than I should have done it myself, by my friend Sir Arthur Herbert. At the same time I may say that this is a subject in which I take the deepest interest. I am not going to discuss the lecture at all, but I read it, and read it carefully, and I endorse every single word that Sir Arthur Herbert has said about the great value of that lecture.

NOTICES OF BOOKS.

The Log of a Jack Tar; or the Life of James Choyce, Master Mariner; with O'Brien's Captivity in France. Edited by Commander V. LOVETT CAMERON, R.N. London: Unwin, 1891. Pp. 379. Size 8½″ × 6″ × 1¼″. Weight under 3 lbs. Price 5*s.*

These two narratives certainly fulfil the purpose of giving an account of the adventures of seamen between 1793 and 1808, and, as Captain Cameron puts it, enable us to form a correct idea of what manner of men they were who formed the crews of the fleets which maintained our naval supremacy in those days. The book is an excellent addition to the Adventure Series, of which it is the sixth volume.

Rulers of India. The Earl of Mayo. By Sir W. W. HUNTER. Oxford: Clarendon Press. 1891. Pp. 206. Size 7¾″ × 5¼″ × 1″. Weight under 14 oz. Price 2*s.* 6*d.*

The consolidation of the Queen's rule in India was the work which was the lot of this Viceroy during his brief tenure of office, commencing in 1869 and terminating in 1872, when he fell under the hand of an assassin. This work included the conciliation of the princes and peoples of India; powers of self-government were accorded to the former, and freedom to participate in public employment to the latter. In these respects the policy of the Company's rule was completely reversed. Decentralization of authority and extension of railway communication were other subjects with which he had to deal; and, finally, he was occupied in building up a cordon of States on the other side of the Sikh frontier, as a breakwater against Russian aggression. Sir W. Hunter has given a full and excellent summary of a brilliant but too short career of public usefulness.

French Revolutionary Generals. By Major ARTHUR GRIFFITHS. London: Chapman and Hall, 1891. Pp. 251. Size 8½″ × 5½″ × 1¼″. Weight under 1 lb. 2 oz. Price 6*s.*

These Generals are Dumouriez, Hoche, Jourdan, and Marceau. Much of the work each had to do was part of work which was common to all. Major Griffiths has taken advantage of this fact to make the French Revolutionary Wars the basis on which he builds up the special biographies. In this small book we have, therefore, a valuable contribution to the military history of the period preceding the great wars of Napoleon. It fills a hiatus in English military literature.

Messrs. Gale and Polden, of Chatham and Aldershot, have sent us:—

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